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Comprehensive Solid Waste Management Study of Energy and Resource Recovery, Chautauqua County, New York

New York State Dept of Environmental Conservation, Albany

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Comprehensive Solid Waste Management Study Of Energy And Resource Recovery

Chautauqua County, New York

August 1976

Funded by:

The New York Department of
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August 23, 1976

Mr. Peter A. A. Berle, Commissioner
New York State Department
of Environmental Conservation
50 Wolf Road
Albany, New York 12201

The Chautauqua County
Planning Board
County Court House Annex
Mayville, New York 14757

Attention: Mr. John R. Luensman
Planning Director

Re: Comprehensive Solid Waste Management
Study of Energy and Resource
Recovery
Chautauqua County, New York
Project No. C99102
W.O. 06-7126-000

Gentlemen:

In accordance with our Contract No. C99102, dated March 20, 1975, we are pleased to submit 150 copies of our final report on energy and resource recovery from solid wastes in Chautauqua County. One hundred copies of the report are being forwarded to the Chautauqua County Planning Board and fifty copies to the New York State Department of Environmental Conservation.

For convenience an Executive Summary has been prepared, outlining the major topics and results of the study. The Executive Summary is presented at the beginning of the report, followed by a detailed description of the investigations, analyses, and findings. The Conclusions and recommendations are presented at the end of Chapter 7, followed by a recommended implementation strategy in Chapter 8.

We trust that the information provided will enable Chautauqua County to evaluate the potential for energy and resource recovery.

We wish to thank the Chautauqua County Planning Board, and the Department of Public Works - Division of Environment for their assistance in the completion of this report. It is our desire to cooperate in any way to provide assistance to Chautauqua County and the New York State Department of Environmental Conservation to implement the plan.

It will be our pleasure to meet with you to discuss any aspect of the study at your convenience.

Very truly yours,

GILBERT/COMMONWEALTH ASSOCIATES

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1 a)

ACKNOWLEDGEMENT

This comprehensive plan of solid waste energy and materials recovery for Chautauqua County will enable the County government to evaluate the potential for resource recovery in Chautauqua County. The Comprehensive Solid Waste study was initiated at the request of Chautauqua County Executive and Legislature through application made by the County Planning Board pursuant to Article 27, Title I of the Environmental Conservation Law, financially assisted in full by the New York State Department of Environmental Conservation.

HUGH CAREY
Governor

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Department of Environmental Conservation

JOSEPH GERACE
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Chautauqua County

The cooperation of the following individuals during the initial contract phases and administration of the study is gratefully acknowledged:

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We would like to express our particular appreciation to the following State, County, and Municipal representatives for their continual assistance and cooperation throughout the study:

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The cooperation and assistance of the personnel from the Chautauqua County Planning Board, Department of Public Works - Division of Environment and the New York State Department of Environmental Conservation in the preparation of this report is gratefully appreciated.

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EXECUTIVE SUMMARY

This report is a comprehensive study of solid waste generation in Chautauqua County and the potential for energy and materials recovery from these wastes. The primary objective of this report is to determine the feasibility of a solid waste disposal plan encompassing resource and energy recovery for Chautauqua County.

There are six major topics presented in this report, all evolving around the feasibility evaluation of a municipal waste resource recovery system.

These topic areas are:

1. The existing solid waste disposal system and determination of waste quantities for design parameters by a field weighing program.
2. Examination of existing and potential energy and materials markets which would utilize the recovered waste products.
3. Review of existing energy resource recovery technologies applicable to Chautauqua County energy markets.
4. Study of waste transport schemes for various resource recovery processing plant/fuel user locations.
5. Determination of specific solid and gaseous refuse derived fuel systems and application to site-specific energy user conditions.
6. Suggested implementation strategy.

Study Area and Existing Solid Waste Disposal System

Chautauqua County is located in the extreme southwest corner of New York State and is approximately 1,080 square miles in area.

It is bordered by Lake Erie on the north, by Pennsylvania from the south and west and Cattaraugus and Erie Counties, New York on the east. The population is approximately 57 percent urban, 34 percent rural non-farm and 9 percent rural farm. Jamestown and Dunkirk have the bulk of industry and urban population. The 1975 permanent population is 149,410 people.

The existing solid waste disposal system consists of three santiary landfills, one near the city of Dunkirk, one at South Stockton and in the municipality of Chautauqua. In rural areas where there is no organized municipal, contract or private collection, the residents bring their wastes to one of the three landfill sites for disposal. No disposal fees are charged at the landfills; the operation is conducted and maintained by the County and derives its revenues for operation from taxes. Industries also utilize the landfills, but only for non-toxic wastes. Potentially hazardous and toxic wastes are the responsibility of the individual industries for disposal.

Solid Waste Generation and Classification

Solid waste generation and constituent mix was investigated in Chautauqua County during a two week field weighing and sampling program conducted at two landfill sites. Incoming wastes were weighed on portable scales prior to disposal in the landfill. The estimated per capita waste generation for Chautauqua County in 1975 is:

	LBS/Capita/Day
Residential and Commercial Wastes	4.00
Yard cleanup	0.20
Industrial	4.06
TOTAL	8.26

The projected waste quantity for 1985, used for the system design waste quantity, is 660 tons per day. A resource recovery system would accept municipal combustible and non-combustible wastes and industrial combustible wastes only. This results in approximately 132,700 tons of wastes per year or 430 tons per day. Although this represents the estimated waste quantity generated, the amount actually deliverable to a resource recovery facility was reduced 10 percent, based on previous experience with collection practices. Therefore, the estimated 1985 design waste quantity is 385 tons per day throughput in a resource recovery facility, with the remaining 275 tons per day of non-recyclable wastes to sanitary landfills.

Materials recovery from solid wastes possesses potential, based on the preliminary materials market survey. Industries within the regional area of Chautauqua County currently use a variety of secondary materials in their manufacturing processes. Potential difficulties concerning marketing of secondary materials are: (1) various product user specifications which the recovered materials must conform to before they can be considered for reuse, (2) delivery cost associated with shipment of recovered materials to an industry, (3) difficulty in obtaining long term contracts due to the volatile nature of the secondary materials market. Optimistic aspects of secondary materials recovery are: (1) secondary materials dealers are the primary source for secondary materials used by industry, therefore, an association with secondary materials dealers could alleviate the marketing of the recovered materials, (2) secondary materials utilized by industry in the Chautauqua County region are; various grades of waste paper, ferrous and non-ferrous metals, glass and some textiles. These materials are present in municipal solid wastes, (3) fourteen manufacturers and three secondary materials dealers expressed an interest in various types of non-virgin materials. These companies are listed in Appendix C-1, Exhibit 27.

Potential energy markets for the combustible portion of solid wastes were investigated in Chautauqua County. Eighteen boiler installations are examined as potential refuse derived fuel users. The potential energy that could be generated from 385 tons per day of unprocessed solid wastes is equivalent to approximately 102,500 pounds per hour of steam over 24 hours (assuming a 75 percent refined waste fuel fraction after processing having 6630 BTU per pound). Therefore, boiler plant installations with average hourly steam loads of 125,000 pounds per hour were initially judged viable refuse derived fuel (RDF candidates. Out of the eighteen installations surveyed, only four steam plant candidates were deemed acceptable, separately or in combination, based on present or projected steal loads. They are (1) Jamestown Board of Public Utilities - Carlson Station (2) Niagara - Mohawk Dunkirk Station, (3) State University of New York - Fredonia Campus Power Plant, (4) Cummins Engine Company. The Niagara - Mohawk Dunkirk Station and the Jamestown BPU Carlson Station presently use pulverized coal and could accept a solid type refuse derived fuel to supplement coal firing. SUNY - Fredonia presently has gas fired boilers and could accept a gasified refuse derived fuel. The Cummins Engine Company is planning to construct a coal fired boiler system that could accept a solid refuse derived fuel. Both the Cummins Engine Company and SUNY - Fredonia Steam loads are not sufficiently large enough to accommodate all of the refuse derived fuel that could be produced from 385 tons of waste per day (30% RDF supplemental firing or less). Therefore, in conjunction with Cummins Engine Company and SUNY - Fredonia, the Jamestown BPU Carlson Station would also utilize a portion of the refuse derived fuel product.

Resource Recovery Systems

Two basic resource recovery systems are examined for use in Chautauqua County.

1. A resource recovery system that has the capability of producing a solid-refuse derived fuel supplement as well as ferrous - non-ferrous materials recovery.

2. A resource recovery system that produces a gaseous - refuse derived fuel supplement and ferrous materials recovery.

The solid-refuse derived fuel waste processing facility consists of a primary shredder, magnetic ferrous metal removal, trommel (non-ferrous removal) or air classifier if desired, secondary shredder and pneumatic conveyance to fuel user.

The solid-refuse derived fuel supplment itself consists of a 75 percent refined fuel fraction having 16 percent moisture and 15 percent inerts, and 6630 BTU per pound. From a daily input of 385 tons of unprocessed wastes, the resource recovery facility will generate approximately 287 tons per day of solid refuse derived fuel supplement. Approximately 20 tons per day of moisture is lost in the waste processing and 79 tons per day of recovered secondary materials/process resudue is either marketed or landfilled. The potential energy available in 287 tons of refuse derived fuel is approximately 2,660 million BTU per day which is equivalent to approximately 102,100 pound per hour of steam generation over 24 hours.

If the supplemental waste fuel has a value of $1.00 per million BTU, this corresponds to $10.88 per ton of refined fuel fraction or approximately $3,120 per day.

The gaseous refuse derived fuel supplement system considered most practical under the circumstance is the Union Carbide Corporation - Purox Process. Other gasification systems were not considered viable essentially because of the low heating value of the refuse derived fuel gas (lower than 300 BTU per standard cubic foot.) The Purox gas is between 300 to 350 BTU per standard cubic foot. Lower gas heating values may require derating of boiler units as well as the requirement for modifications of boiler fuel piping, ducts and burners.

The Purox waste gasification system consists of refuse shredding, magnetic ferrous removal, gasification, and gas clean-up train. The Purox system is constructed in 350 ton per day module units, which would yield approximately 67 tons per day of ferrous metal and granular aggregate for marketing or landfill disposal, and 252 tons per day of fuel gas. The fuel gas possesses approximately 5.25 million BTU per ton of waste processed or 1,840 million BTU per day. At $1.00 per million BTU this results in $2,150 per day for the Purox gas available from 350 tons per day. If the Purox gas revenue potential is compared to the solid RDF revenue potential for the same waste quantity processed daily, the solid RDF will generate approximately 31 percent more revenue than the Purox gas, because of the relative energy equivalent per ton of waste processed for each system.

General non-site specific solid and gaseous refuse derived fuel processing facility's costs are as follows:

		Solid RDF Facility @ 385 TPD	Purox Gas Facility @ 350 TPD
1.	Estimated Capital Cost	$4,459,000	$18,799,400
2.	50% NYSDEC Construction Grant	-2,229,500	-9,399,700
3.	Capital Cost local share	$2,229,500	$ 9,399,700
4.	Annual Cost (a)	$ 978,800	$ 3,439,100
5.	Estimated Annual Revenue (b)	- 749,000	- 516,200
6.	Estimated Annual Operating Costs	$ 229,800	$ 2,922,900
7.	Estimated Cost per Ton	$ 2.11	$ 29.60

(a) Includes Debt Service of 7% for 10 years, financing coverage at 15% and annual plant operating costs.

(b) Revenue potential at $0.85 per million BTU; assumed to be 75% of conventional fuel costs of $1.15 per million BTU. Coal at 12,500 BTU/LB at $1.15 per million BTU equals $28.75 per ton.

Waste Transport Scheme Analysis

Waste transport costs associated with potential resource recovery locations in Chautauqua County are examined. The waste transport costs are not "household collection" costs, but the costs associated with transporting a waste quantity from a waste generating centroid in each town or municipality to the resource recovery plant or transfer station. Waste transport costs are presently not allocated to the County cost of landfill operation This may also be true for resource recovery facilities, depending upon which waste transport scheme is actually utilized. The County would incur waste transport costs if a transfer station is built as part of the resource recovery system operation, by assuming the responsibility for capital and operating costs. If no transfer stations are constructed, the County will only be responsible for the transport of waste residues and non-marketable materials to the landfill for disposal.

Since it is ultimately the consumer who will pay for waste transport, whether it is a County or private industry operation, five waste transport schemes were esamined for resource recovery facilities in Jamestown or Dunkirk, with and without the use of a transfer station. The "Total Waste" transport costs are compared to evaluate the most economical overall waste transport scheme. "Direct County" waste transport costs are those costs that Chautauqua County would be responsible for if that particular Scheme is implemented, such as transfer station operating costs and resource recovery process residue transport costs to a landfill for disposal. "Total Waste" transport cost includes the Direct County costs plus the cost to direct haul wastes to a transfer station or resource recovery plant for processing, cost to transport wastes directly to the landfill for a 30 day period each year due to resource recovery plant/fuel user shutdown, and the cost to transport non-processable non-recyclable wastes to the landfill for disposal.

When the "Total Waste" transport costs are compared, the most efficient system for total County waste transport will be obvious. Referring to the following waste transport schemes and costs:

Waste Transport Scheme	Estimated Direct County Waste Transport Costs		Estimated Total County Waste Transport Costs	
	Annual	Per Ton	Annual	Per Ton
I: One resource recovery (R.R.) facility in Jamestown; transfer station in Dunkirk; R.R. Residue to proposed Busti Landfill	$301,900	$2.30	$797,300	$3.50
II: One resource recovery facility in Dunkirk; transfer station in Jamestown; R.R. residue to proposed Arkwright landfill	$410,400	$3.15	$887,400	$3.90

Waste Transport Scheme	Estimated Direct County Waste Transport Costs Annual	Per Ton	Estimated Total County Waste Transport Costs Annual	Per Ton
III: Two resource recovery facilities one each in Jamestown and Dunkirk; direct haul all wastes.	$ 85,900	$3.85	$588,700	$2.60
IV: One resource recovery facility in Jamestown; direct haul all wastes.	$ 48,800[a]	$2.20	$802,900	$3.50
V: One resource recovery facility in Dunkirk; direct haul all wastes to facility	$ 51,400[a]	$2.30	$881,500	$3.90
VI: Direct haul all wastes to existing landfills; South Stockton, Dunkirk and Chautauqua.	0	0	$498,200	$2.40
VII: Direct haul all wastes to proposed landfills; Busti and Arkwright	0	0	$537,200	$2.60

Although the lowest "Direct County" waste transport cost for resource recovery is Scheme IV at $48,800, the "Total County" cost is $802,900, which is not the most economic "Total County" waste transport cost. Scheme I is the most economic "Total County" waste transport scheme at $797,300.

It is estimated that the present "Total County" waste transport cost is $498,200, Scheme VI, direct haul to three sanitary landfills. Direct haul to the two proposed landfills in Busti and Arkwright would be approximately $537,200 as "Total County" waste transport costs, Scheme VII. There is no Direct County costs associated with the current landfill options, since transfer stations are not needed if the landfills are located in the approximate areas of Arkwright and Busti.

Site Specific Energy Recovery Schemes

Seven site specific energy and materials resource recovery schemes are examined for Chautauqua County. These seven site specific schemes evolve around the four potential RDF energy users; Jamestown BPU Carlson Station, Niagara - Mohawk Dunkirk Station, SUNY - Fredonia Campus, and the Cummins Engine Company. The seven site specific resource recovery alternatives are:

1. Alternative A: Energy recovery at the Jamestown BPU Carlson station, utilizing a solid-refuse derived fuel

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(a) This Direct County Cost is only for the transport of resource recovery processing plant residue to the sanitary landfill for disposal.

2. Alternative B: Energy recovery at the Jamestown BPU Carlson station utilizing the Purox gasified refuse derived fuel.

3. Alternative C-1: Energy recovery at two locations: (1) SUNY - Fredonia, utilizing a gasified-refuse derived fuel (Purox) and (2) Jamestown BPU Carlson utilizing a solid-refuse derived fuel.

4. Alternative C-2: Energy recovery at two locations: (1) Cummings Engine Company and (2) Jamestown BPU Carlson Station, both utilizing a solid-refuse derived fuel.

5. Alternative D-1: Energy recovery at the Niagara - Mohawk Dunkirk station utilizing a solid-refuse derived fuel from Chautauqua and Erie Counties. Chautauqua County uses it's own resource recovery plant to produce a solid RDF.

6. Alternative D-2: Energy recovery at the Niagara - Mohawk Dunkirk station utilizing a solid-refuse derived fuel from Chautauqua County only.

7. Alternative E: Transfer Chautauqua County processable wastes to the Erie County - Niagara Mohawk resource recovery facility for processing into a solid-refuse derived fuel.

Alternatives A, B and C-2 include a transfer station located in Dunkirk for transfer of wastes to Jamestown. Alternative C-1 does not include a transfer station, since the location of the two resource recovery facilities are near Dunkirk and Jamestown. Alternatives D-1 and D-2 include a transfer station located in Jamestown, for transfer of wastes to Dunkirk. Alternative E includes two transfer stations, one in Jamestown and one in Dunkirk, for transfer of all Chautauqua County processable wastes to the Erie County - Niagara Mohawk resource recovery facility in Erie County.

Provided is an estimate of the Capital and Operating costs of the various alternatives, including the 50% New York State Department of Environmental Conservation Capital Construction Grant. For alternatives B and C-1, in which the Purox gasification system is considered for the Jamestown BPU and SUNY-Fredonia, costs are also developed for the possibility of obtaining a 100% construction grant. (50% construction grant from NYSDEC and 50% from either the fuel user or possibly a federal grant.)

Also included in the annual operating costs for alternatives A and B is an examination of the total County Costs if: (a) the Jamestown BPU is charged 75% of their present fuel costs for the refuse derived fuel ($0.85 per Million BTU) by the County to offset it's operating expenses, (b) the refuse derived fuel is given to the Jamestown BPU for free - no charge and the entire cost of the resource recovery system is absorbed by the County.

ESTIMATED RESOURCE RECOVERY SYSTEM CAPITAL COSTS[a]

	Total System Capital Cost	NYSDEC[b] Grant	Chautauqua County Capital Cost Local Share
1. **ALTERNATIVE A** Jamestown BPU; Solid-RDF	$ 5,610,000	$ 2,685,000	$ 2,925,000
2. **ALTERNATIVE B** Jamestown BPU; gas-RDF	19,940,600	9,850,300	10,090,300
3. **ALTERNATIVE C-1** SUNY-Fredonia; gas-RDF Jamestown BPU; solid-RDF	23,695,300	11,847,700	11,847,700
4. **ALTERNATIVE C-2** Cummins Engine Co; solid-RDF Jamestown BPU; solid-RDF	7,450,900	3,605,500	3,845,500
5. **ALTERNATIVE D-1** Niagara-Mohawk; Solid-RDF from Chautauqua & Erie counties	4,859,000	2,260,300	2,598,700
6. **ALTERNATIVE D-2** Niagara-Mohawk; Solid RDF from Chautauqua Co. only	5,807,000	2,734,300	3,072,700
7. **ALTERNATIVE E** Transfer Chautauqua Co. Wastes to Erie Co. Resource Recovery Facility	1,097,000	274,250	822,750

(a) Does not include Capital Cost associated with constructing additional landfill disposal sites. This could add an additional $2,000,000 to the Local Chautauqua County Capital Costs.

(b) Includes 50% NYSDEC Construction Grant for resource recovery facility and 25% NYDEC construction grant for transfer stations.

The annual resource recovery total system costs presented include: (a) cost to own and operate the resource recovery facility, (b) direct county waste transport cost, (c) estimated landfill cost savings incurred since some wastes are recovered instead of landfilled, (e) estimated revenue from sale of the refuse derived fuel. It is assumed no revenue is derived from materials recovery. Table 7-27 has the above costs and credits listed separately.

ESTIMATED ANNUAL RESOURCE RECOVERY SYSTEM COSTS

	Total System Chautauqua County Annual Costs Including RDF Revenues	Cost Per Ton(a)
1. ALTERNATIVE A		
Jamestown BPU: Solid-RDF		
- Charge BPU for RDF @ $0.85/MBTU	$ 1,113,000	$ 5.40
- No charge to BPU for RDF	$ 1,862,000	$ 9.00
2. ALTERNATIVE B		
Jamestown BPU: Gas-RDF		
50% construction grant:		
- Charge BPU for RDF @ $0.85/MBTU	$ 3,587,500	$17.40
- No charge to BPU for RDF	$ 4,103,700	$19.90
100% construction grant:		
- Charge BPU for RDF @ $0.85/MBTU	$ 1,994,500	$ 9.70
- No charge to BPU for RDF	$ 2,510,500	$12.20
3. ALTERNATIVE C-1		
SUNY-Fredonia: Gas-RDF		
Jamestown BPU: Solid-RDF		
50% construction grant:		
- combined system costs	$ 3,754,100	$18.20
100% construction grant:		
- combined system costs	$ 2,228,400	$10.80
4. ALTERNATIVE C-2		
Cummins Engine Co: Solid-RDF		
Jamestown BPU: Solid-RDF		
- combined system costs	$ 1,422,800	$ 6.90
5. ALTERNATIVE D-1		
Niagara-Mohawk: Solid-RDF from Chautauqua and Erie counties	$ 865,600	$ 4.20
6. ALTERNATIVE D-2		
Niagara-Mohawk; Solid-RDF from Chautauqua Co. only	$ 943,200	$ 4.60
7. ALTERNATIVE E		
Transfer Chautauqua Co. Wastes to Erie Co. Resource Recovery Facility	$ 770,200	$3.75

(a) Total 1985 waste quantity estimated at 660 tons per day or 205,920 tons per year. Since the annual costs or cost per ton include the annual costs associated with resource recovery and landfill disposal for the entire County wastes, these costs are Total Waste Disposal Cost estimates for Chautauqua County.

SUMMARY RECOMMENDATIONS AND CONCLUSIONS

RECOMMENDATIONS

In light of the close comparison of costs for Alternatives E, D-1, D-2, and A, all within a $1.65 per ton range, several recommended options for Chautauqua County are given:

1) Beginning with the least total cost resource recovery system (Alternative E), utilizing the Erie County-Niagara Mohawk resource recovery processing system, via transfer trailer hauling of Chautauqua unprocessed wastes, Chautauqua County officials should explore, with the appropriate Erie County and Niagara-Mohawk officials, the possibility of implementing a regional multi-county resource recovery system. It will be necessary to initially explore Niagara-Mohawk's interest to participate in such a proposal with Chautauqua County. Focal points of the initial discussion could include:

   - will potential problems arise from transporting processed and unprocessed wastes across county boundaries;
   - residue management from processed wastes at the resource recovery facility;
   - Niagara-Mohawk Erie County tipping fees;
   - potential RDF revenue posture of Erie County with respect to sale of contributing Chautauqua County RDF;
   - capital contributions;
   - basic type agreement necessary between Niagara-Mohawk, Erie County and Chautauqua County;
   - length of agreement.

2) Should the discussions concerning potential implementation of Alternative E not prove fruitful, Chautauqua County officials could then approach Niagara-Mohawk with the recommended program outlined for Alternative D-1, which provides that Chautauqua County construct its own resource recovery facility, but utilize the Niagara-Mohawk-Dunkirk Station as a fuel user of solid-RDF along with Erie County wastes. Chautauqua County would deliver solid-RDF to the receiving area at the Dunkirk Station. Thus, the only interface with Erie County wastes would be that Chautauqua County would use the same RDF receiving area at the Dunkirk Station. It should be noted again that the Chautauqua County and Erie County solid-RDF are both being processed to a 75 percent refined fuel fraction. Therefore, it is anticipated that there will not be any significant difference in burning characteristics. Each processing plant will be required to maintain the necessary quality control.

3) If the Erie County Wastes are not utilized at the Dunkirk Power Station, Chautauqua County could follow the plan outlined in Alternative D-2, which includes Chautauqua County constructing its own resource recovery system and utilizing the Dunkirk Power Station as an RDF fuel user. The difference between Alternatives D-1 and D-2 is that Erie County Wastes are not utilized at the Dunkirk Station, at least at that point in time. The Chautauqua County officials could contact the Niagara-Mohawk Power Company to work out the details of the proposed resource recovery plan outlined in Alternative D-2.

4) Should terms with the Niagara-Mohawk Power Company not be workable, Chautauqua County officials could proceed to discuss the plan outlined in Alternative A - utilizing the Jamestown BPU Carlson Station with a solid-RDF supplement.

If the BPU is not willing to accept all the solid-RDF, the Cummins Engine Company at Lakewood should be contacted and talks should then proceed with the Jamestown BPU and Cummins Engine Company officials, both using a solid-RDF. This is the plan outlined for Alternative C-2. Required here will be a commitment from the Cummins Engine Company as to (1) when they plan to construct their new boiler facility, (2) insure that the new boiler facility will be capable of accepting a solid prepared refuse derived fuel; (3) insure their load projections for the boiler facility are at least those used to determine the feasibility of this Alternative (80,000 pph steam over 24 hours); (4) it would be desirable if the new boiler facility could be designed to accept a greater portion of RDF that was expressed as a minimum in the Alternative C-2 discussion, so that during BPU outages for repair, etc., the Cummins Engine Company facility could accept at least some of the excess RDF. This greater capacity would also reduce on-site storage requirements at Cummins.

5) Once a definite fuel user(s) has been established, the county should then pursue a detailed feasibility study with preliminary design to obtain definitive costs for the resource recovery system finally selected.

6) Should the New York State Department of Environmental Conservation Construction Grant for 50% of the capital costs not be available, Chautauqua County could consider proceeding with the three top ranked resource recovery alternatives E, D-1, and D-2. The costs for each of these alternatives, with and without the grant, have been presented in Table 7-29.

Since the incremental additional costs per ton is small with the NYSDEC Construction Grant, for the first four recommended alternatives (E, D-1, D-2, A), the County should proceed to implement one of these programs.

IMPLEMENTATION STRATEGY

The implementation of one of the resource recovery plans previously presented will involve developing a definite operating-ownership arrangement between the potential fuel user and the County. As soon as the fuel user has been determined and the Contractual agreements drawn up, the County will need to establish an organization within the County government to handle the daily operation of the resource recovery system.

Potential arrangements that could be made between the perspective fuel user and the County are as follows:

1. Chautauqua County builds, owns, and operates the solid-RDF resource recovery facility. The fuel user(s) maintains his receiving RDF and boiler feed installation.

2. Chautauqua County and the fuel user(s) jointly construct, own, and operate the resource recovery facility.

3. Chautauqua County owns the resource recovery facility, the fuel user operates the facility. The County provides the wastes to the facility and removes the residuals.

4. Chautauqua County only provides waste to the resource recovery facility (removes the residuals). The fuel user owns and operates the resource recovery facility.

5. Chautauqua County contracts with private industry to either operate, build and operate; or build, own and operate a resource recovery facility. Depending on the arrangement, either private industry or Chautauqua County would contract with a fuel user(s), and for sale of recoverable secondary materials.

Costs of the above schemes will, of course, be an important criteria in determining the final scheme selected. An important aspect of County involvement in the owning of the resource recovery facility is that the New York State DEC Construction Grant for 50% of the capital costs will be available and, at least theoretically, offset County disposal costs. If the County does not participate in ownership of the resource recovery facility, the grant monies for the facility might be forfeited. Should the fuel user elect to operate the facility, he may feel that he has better quality control of the product RDF to be utilized, and this could be a desirable aspect for the fuel user and avoids potential interface problems.

Contractual agreements between the County and the fuel user will vary, depending upon the type and complexity of the actual resource recovery plan implemented. Listed in Chapter 8 are several important considerations in developing contractual agreements between the County and a RDF fuel user.

Also in Chapter 8 is a suggested County organizational structure to administer the proposed resource recovery system, including the sanitary landfill and transfer station operation.

Possible financing methods for the local Chautauqua County capital share will be governed by the existing state laws regarding County financing. Some possible methods of financing all or part of the resource recovery system capital costs include general obligation bonds, revenue bonds, pollution control bonds or loans.

CHAPTER 1

GENERAL INFORMATION

INTRODUCTION

This Solid Waste Energy and Resource Recovery report was initiated by the County Legislature of Chautauqua County, New York and the New York State Department of Environmental Conservation, under Article 27, Title I of the New York State Environmental Conservation Law.

The primary objective of this report is to determine the feasibility of a solid waste disposal plan encompassing a resources and energy recovery system for Chautauqua County.

This study is to examine:

a. the existing solid waste disposal system and determine waste quantities to be used for design parameters;

b. existing and potential markets for recoverable waste constituents and energy extraction from wastes;

c. types and costs of facilities for waste transport, waste processing and waste materials/energy recovery, and recommend an effective plan for implementation from alternative systems examined.

The report format consists of eight chapters as follows:

CHAPTER 1 - GENERAL INFORMATION. This chapter deals with a brief scope of the project and introductory remarks. A brief description of the study area is also provided.

CHAPTER 2 - WASTE GENERATION, CHARACTERISTICS AND DESIGN QUANTITIES. This chapter deals with the waste weighing and characterization survey performed in April-May, 1975. Present and future wastes quantities and characteristics are projected as a basis for design of future waste recovery/disposal facilities.

CHAPTER 3 - POTENTIAL MARKETS FOR WASTE MATERIALS AND ENERGY RECOVERY. This chapter deals with the market survey for recoverable waste materials and energy from solid wastes. Potential markets and energy customers for waste materials are delineated along with criteria used to make the determinations.

CHAPTER 4 - APPLICABLE ENERGY RESOURCE RECOVERY SYSTEMS. This chapter covers the available practical systems for recovery of energy resources in solid wastes. A brief narrative of the processes and basic flow diagrams is provided, where applicable, along with the current stage of development.

CHAPTER 5 - RESOURCE RECOVERY PROCESSING PLANT REQUIREMENTS. This chapter explains the requirements and details of the two basic resource recovery systems investigated for Chautauqua County, utilizing solid and gaseous prepared refuse derived fuel. Narratives explaining the components of each system as well as capital and operating costs are provided.

CHAPTER 6 - WASTE TRANSPORT SCHEMES FOR VARIOUS RESOURCE RECOVERY PROCESSING PLANT LOCATIONS. This chapter deals with Waste Transport costs to generalized site locations of a resource recovery facility and proposed sanitary landfills within Chautauqua County. The various site locations are selected on the basis of generalized locations of potential solid waste energy users. The waste transport costs also include haul costs to the existing sanitary landfill locations for comparative purposes.

CHAPTER 7 - SITE SPECIFIC ENERGY RECOVERY SCHEMES FOR CHAUTAUQUA COUNTY. This chapter covers the final resource recovery system configurations selected for analysis. Specific site descriptions are presented along with capital and operating costs and appropriate waste transport costs. Recommendations for implementation by Chautauqua County are given.

CHAPTER 8 - IMPLEMENTATION STRATEGY. This chapter provides a discussion suggesting possible alternative methods of organizing and operating the recommended resource recovery system(s) for Chautauqua County.

STUDY AREA

The location of the Study Area, Chautauqua County, New York, is illustrated in Figure 1-1. The county is approximately 1,080 square miles in area. It is bordered on the north by Lake Erie and, from east to west, by Cattaraugus and Erie Counties, New York and Warren and Erie Counties, Pennsylvania.

Land elevations range from 573 feet above mean sea level along the Lake Erie shore line to 2,190 feet in the unglaciated southeast corner of the county. Major topographic features of Chautauqua County are (1) the Lake Erie Plain along the northern border with Lake Erie, reaching inland from three to nine miles, with elevations ranging from Lake Erie level to 900 feet; (2) an escarpment to the south of the Erie Lake Plain, which rises abruptly some 600 feet to an upland plateau; (3) an upland plateau that occupies approximately four-fifths of the county, with elevations ranging from 1,240 feet to 2,190 feet above mean sea level; and (4) Chautauqua Lake, a fresh water body of water some 17 miles long and one-half to two miles wide, located on the inland plateau.

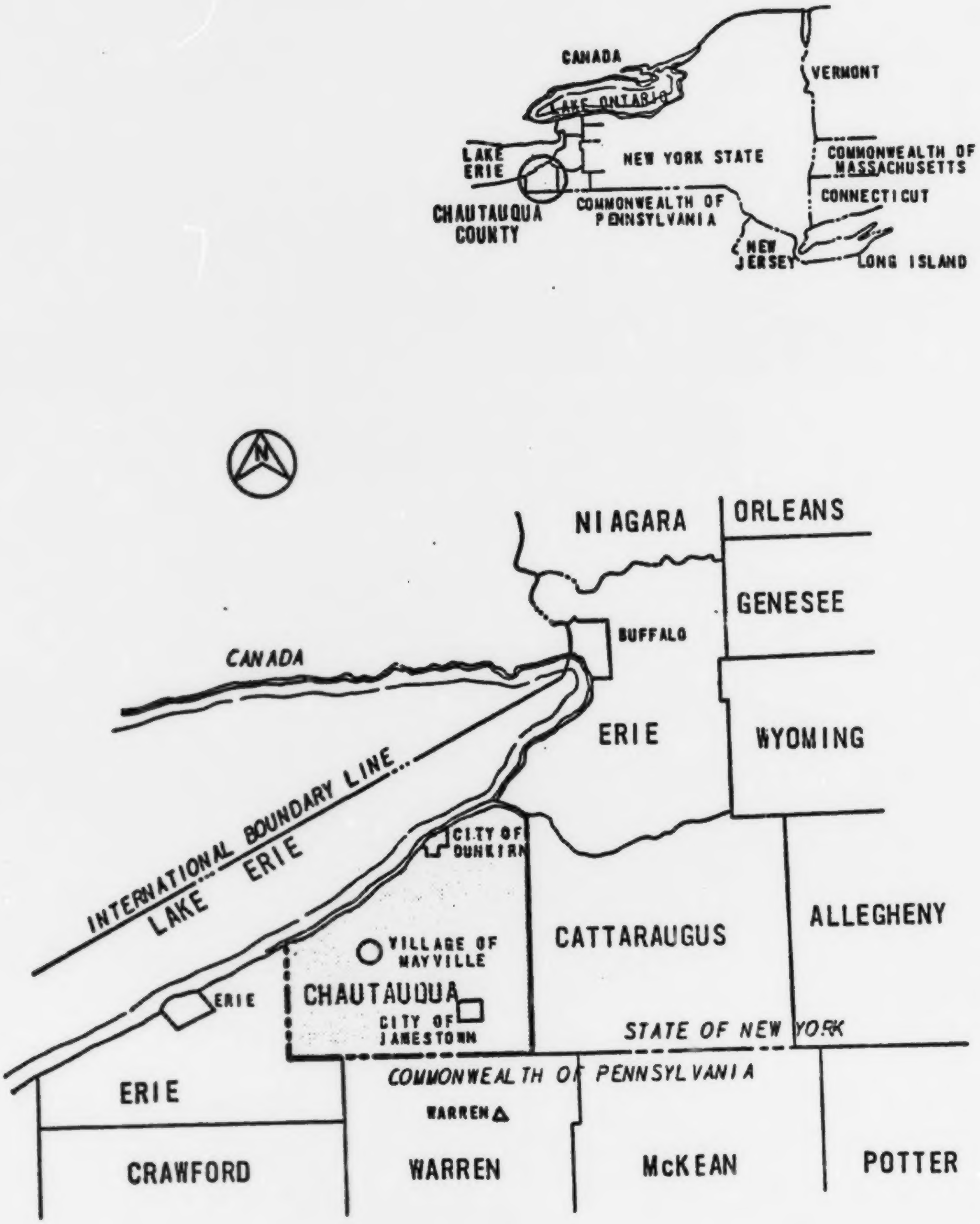

CANADA
LAKE ONTARIO
VERMONT
LAKE ERIE
NEW YORK STATE
COMMONWEALTH OF MASSACHUSETTS
CHAUTAUQUA COUNTY
COMMONWEALTH OF PENNSYLVANIA
CONNECTICUT
NEW JERSEY
LONG ISLAND
N
NIAGARA
ORLEANS
GENESEE
BUFFALO
CANADA
ERIE
WYOMING
INTERNATIONAL BOUNDARY LINE
LAKE ERIE
CITY OF DUNKIRK
CATTARAUGUS
ALLEGHENY
VILLAGE OF MAYVILLE
CHAUTAUQUA
ERIE
CITY OF JAMESTOWN
STATE OF NEW YORK
COMMONWEALTH OF PENNSYLVANIA
ERIE
WARREN
CRAWFORD
WARREN
McKEAN
POTTER

FIGURE 1-1 LOCATION MAP OF STUDY AREA

The area's soils consist mainly of basic deposits of Gray-Brown Podzolic soils on the Erie Lake Plain, and Podzols and Brown Podzolic soils over the remaining areas.

The population is approximately 57 percent urban, 34 percent rural non-farm and 9 percent rural farm. Jamestown and Dunkirk, the two industrialized areas of the county, have the bulk of the urban concentration. The remaining population is scattered throughout the county, located in small villages and rural agricultural settings. The 1975 permanent population, used for this study, was 149,410. Permanent and seasonal population projections are given in Chapter 2, Table 2-7.(a)

EXISTING SOLID WASTE DISPOSAL SYSTEM

The existing solid waste disposal system consists of three sanitary landfills, operated by Chautauqua County. The location of these three landfills is shown on Figure 6-6, Chapter 6. One landfill is nearby the City of Dunkirk and services the surrounding communities from 8 AM to 4 PM, Monday through Saturday. A second landfill is located in the South Stockton area and services the city of Jamestown and surrounding communities from 8 AM to 4 PM, Monday through Saturday. A third landfill, located in the Municipality of Chautauqua is operated only on a three-day-per-week basis. The county does not charge a disposal fee at any of the landfill sites, but rather obtains the necessary operating funds through county taxes. In this manner, an incentive is provided to utilize the landfill sites, since each taxpayer is paying for his use through taxes. Some areas of the county have organized collection, while others have none. Where there is no organized collection, individual homeowners are responsible for delivering their solid wastes to a landfill.

Large traffic flows at the landfill sites can sometimes cause delays in dumping times; however this usually occurs on Saturdays, and periodically for shorter duration during the week. The large traffic flows are due mainly to homeowners dumping yard or "garage cleaning" wastes brought to the landfill, not from household wastes. Portable dumping bins at the entrance to the landfills are provided for homeowner municipal wastes or garbage, thus eliminating such vehicular traffic flow at the landfill working face. Large bulky items must be taken to the landfill dumping area, and it is such waste loads that cause traffic flow difficulties.

Industries utilize the existing landfills, but only for disposal of non-hazardous, non-toxic wastes at the sites. Potentially hazardous and toxic wastes are the responsibility of the individual industries for disposal. With regard to this report, only combustible industrial solid wastes are considered usable in a resource recovery system oriented towards energy recovery. If this is implemented it will still be the responsibility of individual industries to acquire a final disposal alternative for hazardous and toxic wastes. Since the sanitary landfill will still be an integral part of any resource recovery system considered for Chautauqua County, industries will have to check with the County officials responsible for waste disposal to inquire about the acceptance and disposal of their wastes by the County system. A determination will be made as to whether the industrial waste material can be included at the resource recovery plant, at the landfill site, or not at all.

(a) Source: Chautauqua County Department of Planning and Development.

CHAPTER 2

BASE DATA - DESIGN CRITERIA

INTRODUCTION

A solid wastes survey was conducted at two Chautauqua County landfill sites for a two-week period, April 28 through May 9, 1975. The field survey involved two operations: weighing incoming solid wastes at both the Stockton and Dunkirk Sanitary Landfills and classifying samples of pre-selected loads of incoming solid wastes to determine components. The weighing operation was conducted at both landfill sites simultaneously, while the waste classification survey was conducted for one week at each landfill site. Data obtained from the field survey was correlated to existing solid wastes data to supplement and update the base data used for design criteria.

WEIGHING PROGRAM

Incoming solid wastes were weighed at the Stockton and Dunkirk Sanitary Landfill sites for ten weekdays and one Saturday. The program consisted of weighing all incoming solid wastes; however, only during certain periods of extremely high incoming traffic flow, homeowner's pickup trucks were not weighed. These vehicles were noted on the survey forms along with pertinent information and an estimate of the waste weight. The instances of vehicles not being weighed were infrequent. Less than 3% of the incoming vehicles were so estimated.

Weighing equipment consisted of a set of portable twenty-ton platform truck scales, wooden ramps and one 4 x 8 foot plywood sheet. The scales and ramps were placed on the plywood platform and adjusted into position for different axle widths. Figures 2-1 and 2-2 illustrate the general weighing arrangement. Incoming vehicles were weighed each time, whereas empty vehicles leaving the site were weighed only once. The empty vehicle weight and license number was logged and used later to determine the net weight of wastes brought to the landfill throughout the survey period. Autos were not weighed. Wastes brought by auto were deposited in open-top roll-off containers located so as not to disrupt the traffic flow into the landfill. These containers, as illustrated in Figures 2-3 and 2-4, were weighed and recorded individually before they were emptied.

Data forms were developed to record pertinent information upon incoming solid wastes. Appendix A-1 shows a sample of the actual data form used for the survey. Information obtained for each vehicle consisted of approximate time of entry, origin of the waste, type of collector, (i.e. private, municipal or householder), type of refuse (municipal, commercial or industrial), and gross and tare weights of the vehicle. The license number of each vehicle was recorded to facilitate subsequent identification of vehicle gross and tare weights throughout the two-week survey.

During the survey, a leaflet prepared by the county, was distributed to all drivers of incoming waste hauling vehicles that explained the purpose of the survey. A copy of the leaflet is shown in Appendix A-2.

Figure 2-1

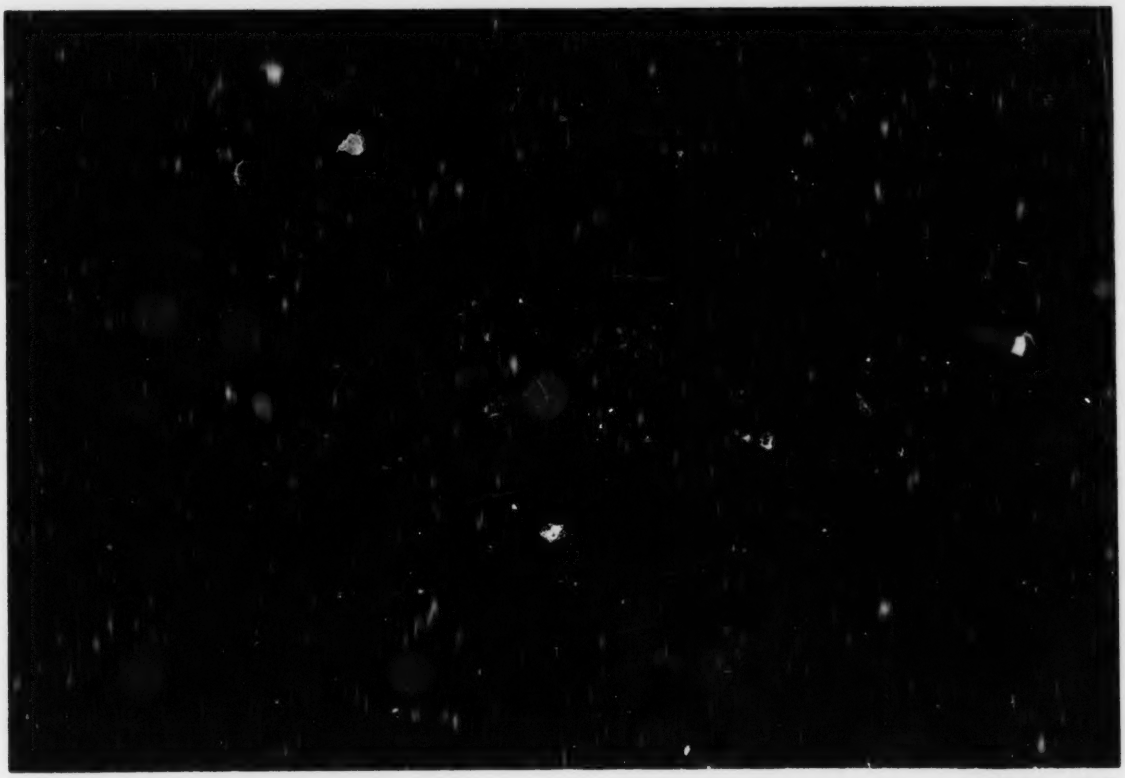


Figure 2-2

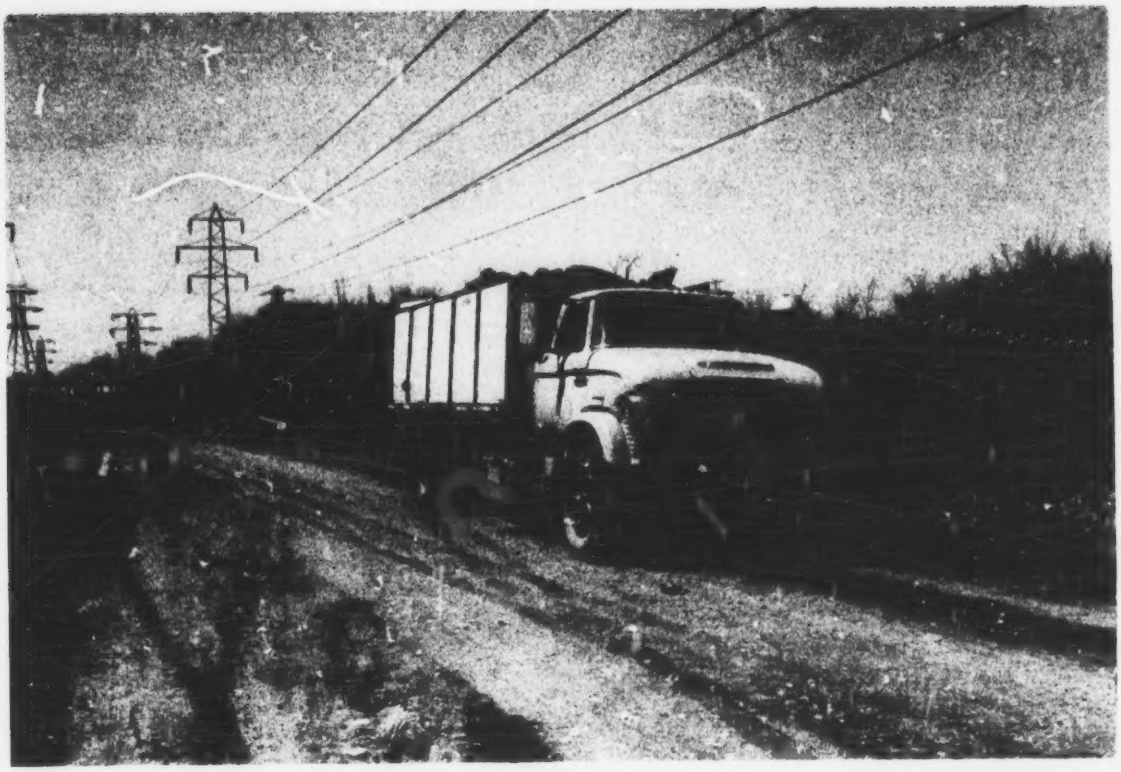
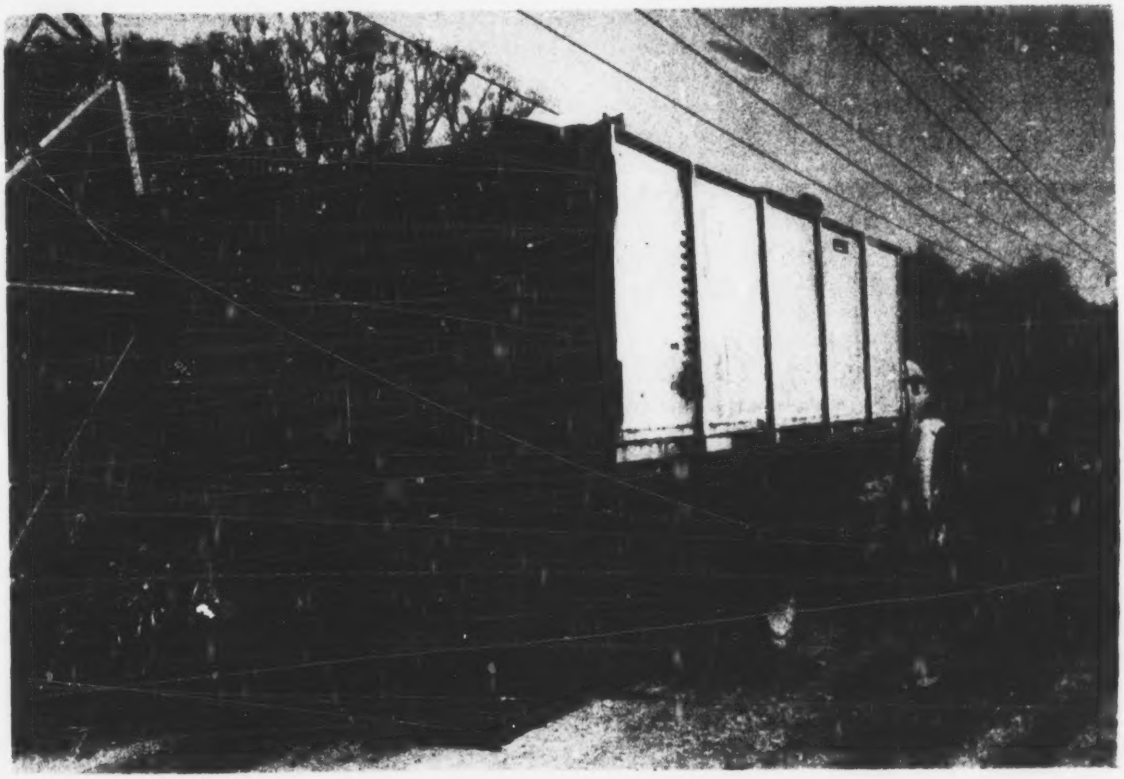


Figure 2-3



2.1-2

Figure 2-4

The procedure for weighing waste hauling vehicles was as follows:

1. The vehicle was stopped short of the scale ramp and the scales together with the ramps were adjusted to the proper axle width.
2. The driver was then directed onto the scale platform by weighing personnel, as illustrated in Figure 2-5.
3. The driver was then asked the questions from the survey data form and also given the explanatory leaflet explaining the purpose of the survey.
4. To obtain the weight of a vehicle the front axle was directed onto the scale platforms. Weight readings were taken from each scale, as shown in Figure 2-6. This procedure was repeated for each additional axle of the vehicle as shown in Figure 2-7.

Figure 2-8 illustrates the method of adjusting the platform scale with the hand crank to obtain the weight readout. Total gross vehicle weight was obtained by adding all scale readout weights. Tare weights were obtained weighing the vehicle empty. Net weight of the refuse was calculated by subtracting the tare vehicle weight from the vehicle gross weight. All types of waste hauling vehicles were weighed, from collectors' pickup trucks to municipal and commercial packer trucks. Figures 2-9, 2-10, and 2-11 illustrate the various vehicle types.

WASTE CATEGORIZATIONS

The purpose of the waste categorization program was to provide an insight as to the actual waste constituents of municipal solid wastes generated in Chautauqua County. Solid wastes samples were obtained from various waste loads brought to the landfill site, chosen to represent a cross-section of typical local municipal solid wastes. To illustrate, waste samples were selected which represented urban, suburban, and rural solid waste generation. Only municipal household solid wastes were sorted since in general all other waste categories (commercial, industrial, etc.), were adequately described and classified by inquiry to the waste hauler during the weighing of the vehicle.

The samples of municipal solid wastes were segregated into the following sixteen components:

1. Paper (corrugated)
2. Paper (newsprint)
3. Paper (all other)
4. Plastic (rigid)
5. Plastic (wrapping)
6. Rubber/Leather
7. Textiles
8. Ferrous Metal
9. Non-ferrous metal
10. Colored glass
11. Clear glass
12. Wood
13. Food wastes
14. Yard wastes
15. Ashes, Rock, Dirt
16. Other (describe)

Figure 2-5

Figure 2-6

22-a

Figure 2-7

Figure 2-8

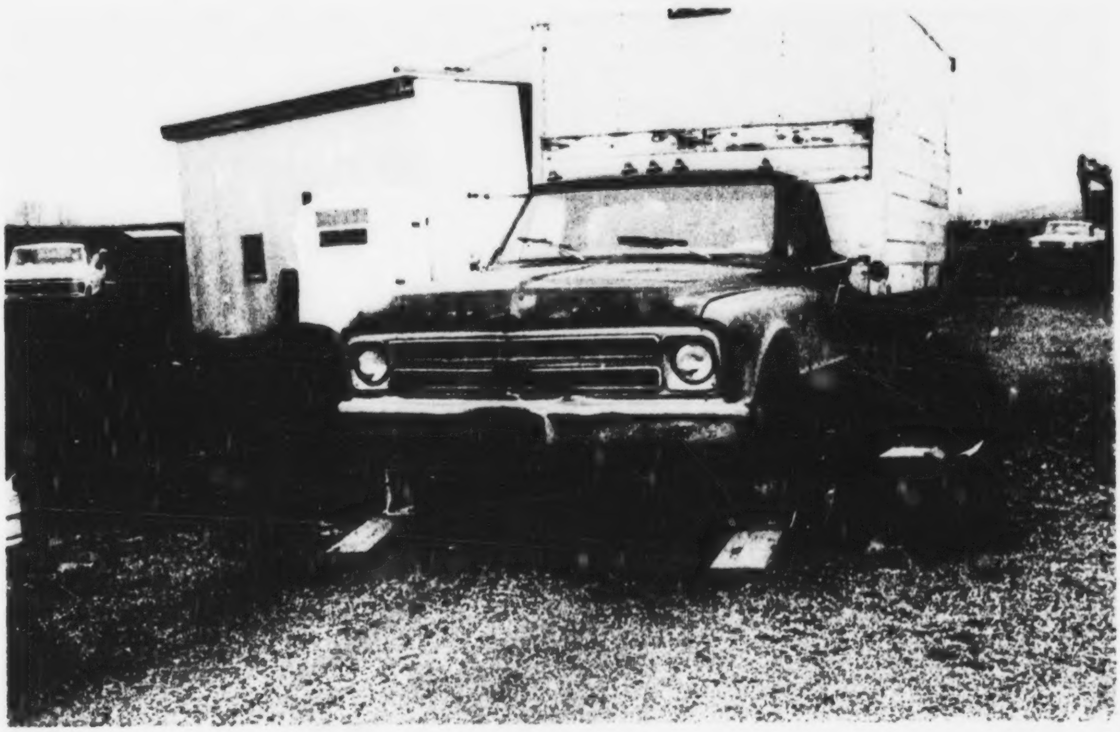


Figure 2-9

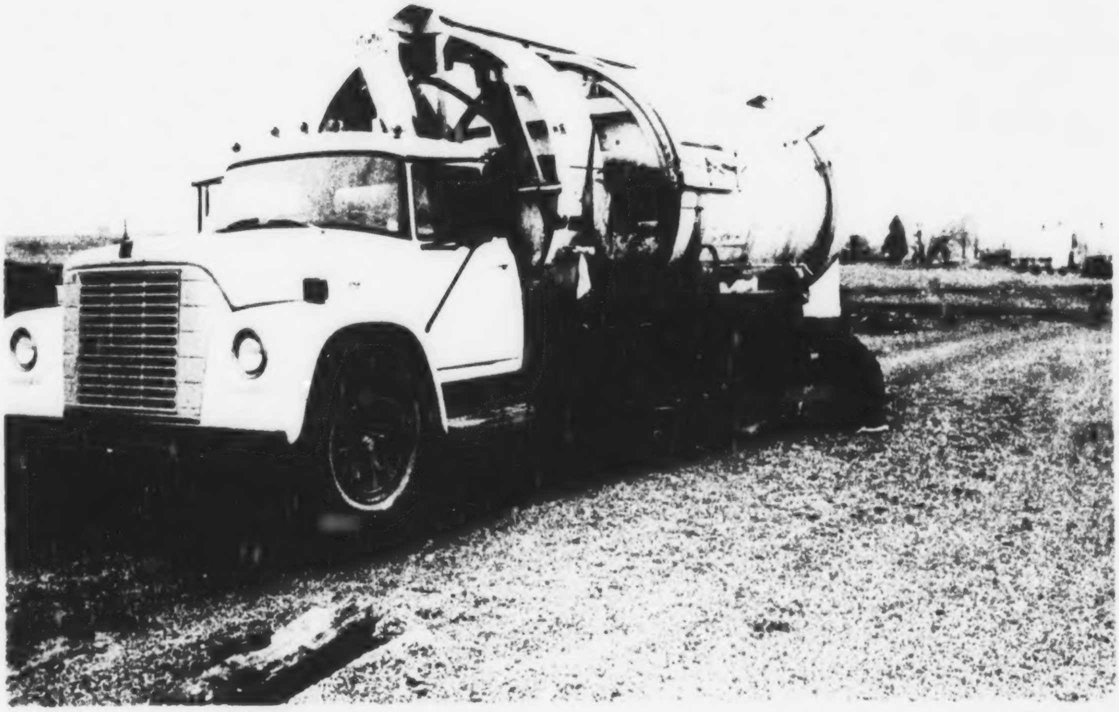


Figure 2-10

7.2-C

Samples were obtained by selecting a load of incoming household refuse and dumping the full refuse load near the working face of the landfill. From this pile of refuse a smaller pile of refuse was constructed by extracting, with a front-end loader, bucket loads of refuse from various sides and elevations of the original refuse pile. The object was to make a smaller representative pile of refuse from the original larger pile, so as to facilitate the identification of the waste components. It was intended that the resultant smaller sample pile of refuse weigh between 200 and 500 pounds. The individual front-end loader bucket loads of refuse were placed, as extracted, into a dump truck that was used to transport the refuse sample pile to the waste categorization area, in the equipment storage building. Having the refuse sample sheltered in this building prevented adverse weather conditions from affecting the sorting/categorization operation.

The refuse sample pile was unloaded from the dump truck onto a sheet of heavy plastic placed on the floor of the equipment building to prevent any other materials from being mixed in the refuse sample pile. Figure 2-12 illustrates a refuse sample pile deposited onto the plastic lining and ready for hand sorting.

The individual waste components, listed previously, were placed into 55 gallon drums as they were hand sorted. Each drum was labeled, identifying the component waste to be placed therein and the tare weight of the drum. When a drum was filled or the sorting operation complete, the individual drums were weighed to obtain their gross weight. After deducting the drum tare weight, the net weight (and percentage) of each sorted waste component from the total sample was then calculated. A copy of the form utilized to record the waste component weights is contained in Appendix A-3.

A typical sample refuse pile is shown in Figure 2-13. In the background the waste component drums and the portable scale appear, used to weigh the drums. Figures 2-14 and 2-15 illustrate the hand sorting operation. Protective rubberized gloves were worn by the individuals sorting the refuse. A portable magnet was used to distinguish ferrous and non-ferrous metals.

Upon classification of the wastes into individual components, a portion of the waste components (3 to 6 pounds) was placed in a large heavy duty plastic bag. The plastic bags were labeled as to waste component contained therein and sample pile origin. The purpose of this procedure was to examine the samples more closely and to perform laboratory analysis if necessary, on those samples for which physical and chemical parameters were lacking or required further verification.

RESULTS OF FIELD SURVEY

The results of the weighing program at the Stockton and Dunkirk sanitary landfill sites are given in Table 2-1. Presented is a summary of daily incoming solid wastes for the entire survey period. The total daily average incoming waste weight for the Kunkirk landfill site is approximately twice that of the Stockton landfill daily average, 310 tons per day versus 156 tons per day, with the respective hourly average rate being 28.2 tons and 17.3 tons

Figure 2-11

Figure 2-12

Figure 2-13

Figure 2-14

2.3-6

Figure 2-15

TABLE 2-1

SUMMARY OF DAILY INCOMING SOLID WASTES
STOCKTON AND DUNKIRK SANITARY LANDFILL SITES
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

Date	Daily Rate Incoming Wastes (Tons)	Hourly Rates(a) Incoming Wastes (Tons)
STOCKTON LAND SITE		
4-28	181.13	20.1
4-29	218.64(b)	24.3(b)
4-30	169.24	18.8
5-1	159.35	17.7
5-2	178.30	19.8
5-3	173.15	19.2
5-5	169.38	18.8
5-6	102.04	11.3
5-7	94.00(c)	10.4(c)
5-8	122.12	13.6
5-9	146.44	16.3
TOTAL DAILY AVERAGE	156.	17.3
DUNKIRK LANDFILL SITE		
4-28	275.16	30.6
4-29	313.54	34.8
4-30	346.30	38.5
5-1	349.55	38.8
5-2	485.05(b)	53.9(b)
5-3	214.93	23.9
5-5	312.25	34.7
5-6	398.51	44.3
5-7	313.79	34.9
5-8	161.55(c)	18.0(c)
5-9	243.67	27.1
TOTAL DAILY AVERAGE	310.	28.2

(a) Hourly period based on a nine-hour operating day.

(b) Largest weight recorded during survey period.

(c) Smallest weight recorded during survey period.

based on a nine-hour operating day. The largest daily waste quantity at Dunkirk was 485 tons (53.9 tons per hour) and the smallest was 161.6 tons (18 tons per hour). At Stockton, the largest daily quantity of wastes recorded was 218.6 tons (24.3 tons per hour) and the smallest was 94 tons (10.4 tons per hour). For the survey period this yields a maximum daily combined total waste receipt rate of 695.6 tons (77.3 tons per hour) and a minimum daily total rate of 255.6 tons (28.4 tons per hour).

A detailed tabulation by municipality, of solid wastes received daily at each surveyed landfill site is given in Appendix B. These wastes were divided into five categories, namely household, commercial, yard cleanup, industrial and demolition wastes. It should be noted that several municipalities were not listed, and that the waste generation quantities fluctuate a great deal in some instances. Since the survey was conducted only at the Stockton and Dunkirk landfills, wastes from some areas of the County may have gone to other County landfill sites not surveyed. This would account for the low generation rates from some communities. Also, during the second week of the survey, the City of Jamestown began its spring cleanup and some wastes were taken to a previously utilized landfill near Jamestown. This accounts for the significantly lower yard cleanup wastes from Jamestown at the Stockton Site during the second week of the survey.

It must be kept in mind that information concerning locational origin of the wastes was provided by the drivers delivering the wastes to the landfill site by truck. Automobiles at the landfill were not weighed nor were the drivers questioned, since they deposited their wastes into transfer containers. As a result, persons in areas with no organized collection service may have brought their wastes by auto and not have been recorded on the field survey forms. Also, some misinformation, or incomplete information concerning locational origin of the refuse, may have been unintentionally given by the drivers of trucks bringing wastes to the landfill, since it cannot be assumed that their loads were always picked up at one point or local area.

Summary tables of the average daily solid waste generation by municipality during the survey period are given for the Stockton Landfill site, in Table 2-2, and for the Dunkirk Landfill site, in Table 2-3. These two tables summarize the data presented in Appendix B, Tables B-1 and B-2.

The household and commercial wastes for both the Stockton and Dunkirk landfill sites equal 295 tons per day, high in comparison to the projections in the Havens and Emerson Report on Solid Wastes in Chautauqua County (228 tons per day) in 1975. An important consideration is that the 295 tons per day does not include wastes from all municipalities. A more detailed discussion will follow in the next section, "Base Data," concerning the adjustment made to account for those municipalities whose wastes were not recorded during the survey period.

Yard cleanup waste quantities may be considered slightly higher than usual for some municipalities, since the annual municipal spring cleanup took place for several towns and villages during the survey period. Also many homeowners were engaged in annual tree prunning, which resulted in considerable brush and tree clippings at the landfill. Demolition wastes were abnormally high for the City of Dunkirk, due to the redevelopment work currently underway. The 43.61 tons per day of demolition wastes will most probably be reduced to 1-5 tons per day under normal circumstances.

TABLE 2-2

SUMMARY OF AVERAGE DAILY SOLID WASTE GENERATION BY MUNICIPALITY
STOCKTON LANDFILL SITE
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975

Municipalities	Household	Commercial	Yard Cleanup	Industrial	Demolition	Total
	Tons Per Survey Day					
Falconer	12.25	1.66	4.49	0.94	-	19.34
Cassadaga	2.31	.44	1.16	.11	-	4.02
Bemus Point	1.44	.09	.43	1.61	.12	3.69
Stockton	1.89	.03	.56	.04	.08	2.60
Sinclairville	2.33	.27	.42	.14	.40	3.56
Ellery	2.34	.06	.04	-	-	2.44
Gerry	1.08	.09	.37	-	-	1.54
Panama	.31	.12	-	-	-	.43
Celoron	1.10	-	-	-	-	1.10
Frewsburg	.92	.03	-	-	-	.95
Fluvanna	.28	-	-	-	-	.28
Ross Mills	-	-	.04	-	-	.04
Ellington	.14	.05	.17	-	-	.36
Busti	2.71	-	-	-	-	2.71
Bear Lake, Pennsylvania	-	.09	.07	.05	-	.21
Kennedy	.87	-	.16	.25	-	1.28
Brocton	.16	-	.04	-	-	.20
Fredonia	.08	-	-	-	-	.08
Ellicott	.61	.25	.08	.54	-	1.48
Dunkirk	.02	-	-	-	-	.02
Mayville	-	-	.08	-	-	.08
Lakewood	3.03	.43	-	-	-	3.46
Maple Springs	-	-	.02	-	-	.02
Cherry Creek	.09	-	-	-	-	.09
Jamestown	68.20	22.77	3.79	10.19	1.30	106.25
Total	102.16	26.38	11.92	13.84	1.90	156.

TABLE 2-3

SUMMARY OF AVERAGE DAILY SOLID WASTE GENERATION BY MUNICIPALITY
DUNKIRK LANDFILL SITE
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975

	Tons Per Survey Day					
Municipalities	Household	Commercial	Yard Cleanup	Industrial	Demolition	Total
Sheridan	.97	.12	.77	.11	-	1.97
Fredonia	37.32	1.98	6.25	5.76	4.65	55.95
Dunkirk	89.96	21.82	19.07	60.97	43.61	235.43
Brocton	2.04	-	-	-	-	2.04
State University	1.58	-	.20	-	-	1.78
Silver Creek	5.52	.18	.28	.10	-	6.08
Hanover	.43	-	-	-	-	.43
Westfield	3.05	-	-	.07	-	3.12
Forestville	.72	.03	.08	-	-	.83
Pomfret	.02	-	-	-	-	.02
Cassadaga	.06	-	-	-	-	.06
Portland	-	.15	-	-	-	.15
Laona	.02	-	-	-	-	.02
Gawgnda	.19	.30	-	-	.33	.82
N. Y. State Thruway			1.69			1.69
Total	141.88	24.58	28.34	67.01	48.59	310.

Industrial wastes were examined more closely, as is shown in Table 2-4. The field survey indicated that a significant amount of industrial wastes was not being brought to the landfills. This could have been due in part to the cyclic or seasonal nature of industrial waste generation, which is not uncommon in some industries, (food processing, for example). Comparing the industrial waste field survey results with those tabulated in the Havens and Emerson Report emphasizes the wide variations in some data. After discussions with Chautauqua County officials, an "adjusted" industrial waste generation daily quantity by municipality was calculated. Special industrial waste categories are shown in Table 2-5. These special industrial wastes were recorded during the field survey, and as illustrated, many of the special wastes are inert and occur in rather small daily quantities.

The Waste Categorization Program was conducted simultaneously with the weighing survey. During this characterization program, five samples of pre-selected refuse loads representing rural, suburban, and urban type refuse were hand-sorted into sixteen component categories at each landfill site, for a total of ten waste sample classifications. Tables B-3 and B-4 in Appendix B, provide the details concerning each waste sample. Information is given concerning date sampled, waste type, and area where waste was collected, sample weight, total weight of refuse from which the sample was taken, percent weight of the waste and the component waste weight of the total waste delivered. From these two tables a composite solid waste sample for Chautauqua County was assembled, Table 2-6. The Total Composite Percentage of Waste Components, by weight, indicates a high percentage of miscellaneous wastes, 24.1 percent. These miscellaneous wastes (a) were primarily small bits of food wastes and paper wastes that had a pasty consistency and remained at the bottom of the sampling pile after all other retrievable constituents had been removed. The scope of work outlined for this report did not permit an in depth breakdown of this waste constituent. However, based on other waste surveys performed by the Consultant and existing literature concerning waste composition, the miscellaneous wastes were allocated according to the following proportions:

Food wastes	9.0%
Paper (newsprint)	4.5%
Paper (all other)	4.5%
Miscellaneous & other unidentifiables	6.1%

Listed in Table 2-6 is an estimate of municipal waste composition by the U.S. Environmental Protection Agency. Comparing the "undistributed" column with the EPA estimate indicates that the paper and food waste categories in the county are much lower that the EPA estimate. As a result, the above distribution was determined appropriate and consistent with previous data. Also,

(a) Consisting of a paste-like material primarily organic in nature mixed with a small amount of dirt and other small inorganic particles, having a high moisture content (30% to 45% by weight).

TABLE 2-4

INDUSTRIAL SOLID WASTE GENERATION
CHAUTAUQUA COUNTY, NEW YORK

Municipality	Field Survey At Stockton and Dunkirk Landfill Sites, April 28 through May 9, 1975	Projected 1975 Industrial Waste Quantities Havens and Emerson Report	Adjusted Industrial Waste Quantities (a) 1975
	TONS PER DAY (c)		
Arkwright	**	-	-
Busti	*	2.15	2.10
Lakewood	*	0.10	0.10
Carrol	*	-	0.00
Frewsburg	*	5.40	5.40
Charlotte	*	-	-
Sinclairville	0.14	-	0.14
Chautauqua	*	0.08	0.08
Mayville	*	12.58	12.58
Cherry Creek	*	-	-
Clymer	*	5.73	5.73
Dunkirk	60.97	130.8 (b)	121.80 (b)
Ellery	*	-	-
Bemus Point	1.61	-	-
Ellicott	0.54	27.49	27.49
Jamestown	10.19	45.68 (b)	54.70 (b)
Celoron	*	0.38	0.38
Falconer	0.94	17.72	17.72
Ellington	*	4.58	4.58
French Creek	**	-	-
Gerry	*	0.003	0.003
Sinclairville	**	-	-
Hanover	*	-	-
Forestville	*	0.17	-
Silver Creek	0.10	3.27	3.27
Harmony	**	0.19	0.19
Panama	*	-	-

TABLE 2-4

INDUSTRIAL SOLID WASTE GENERATION
CHAUTAUQUA COUNTY, NEW YORK

Municipality	Field Survey At Stockton and Dunkirk Landfill Sites, April 28 through May 9, 1975	Projected 1975 Industrial Waste Quantities Havens and Emerson Report	Adjusted Industrial Waste Quantities (a) 1975
	- - - - - - - - - - TONS PER DAY (c)	- - - - - - - - - -	
Kiatone	**	0.04	0.04
Mina	**	-	-
North Harmony	**	-	-
Poland	**	-	-
Pomfret	*	-	-
Fredonia	5.76	14.25	10.00
Portland	*	-	-
Brocton	*	3.90	-
Ripley	**	0.38	0.38
Sheridan	0.11	0.41	0.41
Sherman	**	6.86	6.86
Stockton	0.04	-	-
Cassagada	0.11	6.09	0.11
Villenova	**	-	-
Westfield	0.07	29.80	29.80
TOTAL	80.58	318.02	303.86

NOTE:

* Indicates that no Industrial Wastes were received from this municipality, but other waste categories were brought to the Dunkirk or Stockton Landfill Sites during the survey period.

** Indicated that no Industrial Wastes or any other categories of wastes were brought to the Dunkirk or Stockton Landfill Sites during the survey period.

(a) The Industrial Waste quantities were adjusted after consultation with Chautauqua County.

(b) The 1975 projected Industrial Waste quantities for Jamestown and Dunkirk do not include flyash/bottom ash from electric utilities.

(c) Waste quantities based on a six (6) day week.

TABLE 2-5

SPECIAL INDUSTRIAL WASTE CATEGORIES
FROM WEIGHT SURVEY
APRIL 28, THRU MAY 9, 1975

Waste Type	Survey Period Total Tons Recorded	Average Tons Per Survey Day
Roofing	40.8	3.7
Miscellaneous Metals	23.8	2.2
Steel Dust	105.9	0.6
Paper, Glass & Plastic	100.7	9.2
Ash	19.3	1.8
Sludge	38.7	3.5
Tires	57.9	5.3
Liquid Wastes	13.3	1.2
Printing Ink	3.4	0.3
Catsup	0.6	0.05
Foundry Sand	3.0	0.2
Tin Cans	5.8	0.5
Slag	257.0	23.4
Poultry Farm	0.2	0.02
Leather	0.5	0.04
Rags	1.5	0.01
Grit	11.2	1.0
Dead Animals	0.44	0.04
Fish Processing Wastes	7.67	0.70
TOTAL		62.8

TABLE 2-6

COMPOSITE SOLID WASTE CHARACTERIZATION SAMPLE

CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975

RESIDENTIAL AND COMMERCIAL WASTES SAMPLED

Waste Components Characterized	Total Composite Weight, By Component, of All Refuse Delivered (LBS)	Total Composite Percentage of Waste Components, by Weight (%)		Total Composite Percentage of Waste Components with "Miscellaneous Wastes Distributed (%)		EPA Estimate of General Specifications Waste Categories as Disposed (b) (%)
1. Paper (corrugated)	8,100	10.0	32.0	10.0	41.0	37.8
2. Paper (newsprint)	8,580	11.		15.5		
3. Paper (all others)	8,605	11.0		15.5		
4. Plastic (rigid)	1,541	2.0	3.6	2.0	3.6	3.8
5. Plastic (wrapping)	1,245	1.6		1.6		
6. Rubber/Leather	489	0.6		0.6		2.7
7. Textiles	2,518	3.2		3.2		1.6
8. Ferrous Metals	3,726	4.7	8.4	4.7	8.4	10.1
9. Non-Ferrous Metals	2,936	3.7		3.7		
10. Colored Glass	4,705	5.9	12.0	5.9	12.0	10.0
11. Clear Glass	4,878	6.1		6.1		
12. Wood	722	0.9		0.9		3.7
13. Food Wastes	6,137	7.7		16.7		14.2
14. Yard Wastes	4,955	6.2		6.2		14.6
15. Ashes, Rocks, Dirt	1,069	1.3		1.3		1.5
16. Miscellaneous	19,510	24.1(a)		6.1		-
TOTAL	79,767	100		100		100

(a) This category was primarily food wastes and small bits of paper having a pasty consistency.

(b) Second report to Congress on Resource Recovery and Source Reduction, EPA, 1974, page 3.

2.5-d

realizing from previous work that certain undistinguishable waste items usually remain, 6.1 percent was assigned for miscellaneous waste. The result of the redistribution of miscellaneous wastes appears to correlate well with the EPA estimate of municipal waste composition.

BASE DATA

Population statistics for Chautauqua County were provided by the Chautauqua County Department of Planning & Development, and are tabulated by municipality in Table 2-7. Permanent as well as seasonal populations are shown.

To project the solid waste quantities to future years, it was necessary to project a per-capita waste generation rate. Examining the data collected during the field survey, the residential and commercial wastes as well as total wastes generated by municipality, were correlated to the 1975 population, to determine the actual per capita waste generation rate. The results are shown in Table 2-8. It is evident that the per-capita waste generation rates vary significantly between municipalities. This can be attributed to the reasons given earlier:

a. Automobiles with wastes were not identified by origin.

b. Possible unintentional misinformation by truck drivers delivering wastes to the landfill concerning origin of the wastes. For example, the per-capita waste generation rates for Dunkirk and Pomfret are high compared to the surrounding communities of Sheridan, Hanover, Arkwright and Portland.

c. Certain communities used the County landfill site near Mayville not being surveyed. Although it was only open three days per week it probably accounted for some of the low waste generation rates.

It is evident that the per-capita waste generation rates for those communities near unsurveyed landfill sites were not entirely valid. It therefore proved necessary to develop an adjusted per-capita waste generation rate for Chautauqua County, which would account for wastes not recorded during the survey period and more nearly reflect the actual wastes generated.

Four major classifications were established: (1) residential and commercial, (2) yard cleanup, (3) industrial and (4) demolition. Table 2-9 provides a summary of per-capita waste generation rates for Chautauqua County. The first column indicates the per-capita waste generation rates obtained from the field survey of April 28 through May 9, 1975 (eleven days), yielding a total of 6.25 pounds per-capita per day, generated on a six-day basis. The demolition wastes of 0.68 pounds per-capita per day were high, due to the urban renewal project in Dunkirk. Residential and commercial and industrial waste rates were low, as previously explained in the earlier part of the Base Data Section.

The 1971 Havens and Emerson Solid Waste Report projected a higher overall daily per-capita rate of 7.96 pounds in 1975. However, that rate was primarily postulated upon increased industrial waste contribution. The residential and commercial per-capita rate of 3.96 pounds per day does coincide with the current survey per capita rate of 3.95 pounds per day. However, the present survey rate is considered low, since it does not reflect all wastes generated in the County.

TABLE 2-7

POPULATION PROJECTIONS
PERMANENT AND SEASONAL
CHAUTAUQUA COUNTY CITIES AND TOWNS

	1975		1985		1995		2010	
	PERM	SEAS	PERM	SEAS	PERM	SEAS	PERM	SEAS
Dunkirk	17,010	912	17,229	953	17,583	982	18,047	1,057
Jamestown	40,161	298	40,680	312	41,515	321	42,610	335
Arkwright	848	295	860	309	878	318	901	332
Busti	8,520	2,089	8,831	2,183	9,003	2,250	9,251	2,349
Lakewood								
Carroll	3,172	430	3,287	450	3,354	463	3,443	404
Frewsburg								
Charlotte	1,425	204	1,476	213	1,508	219	1,547	229
Sinclairville								
Chautauqua	4,420	6,830	4,581	7,140	4,676	7,362	4,799	7,687
Mayville								
Cherry Creek	1,161	166	1,177	174	1,201	179	1,233	186
Cherry Creek								
Clymer	1,377	30	1,395	31	1,424	32	1,462	34
Dunkirk	1,727	949	1,802	992	1,839	1,022	1,888	1,067
Ellery	4,678	5,166	4,878	5,400	4,977	5,568	5,108	5,813
Bemus Point								
Ellicott	10,420	171	10,688	179	10,887	184	11,174	192
Celoron								
Falconer								
Ellington	1,409	300	1,429	314	1,458	323	1,496	338
French Creek	863	180	892	188	910	194	934	203
Gerry	1,666	269	1,722	281	1,757	290	1,803	303
Sinclairville								
Hanover	7,972	3,567	8,241	3,728	8,410	3,845	8,631	4,015
Forestville								
Silver Creek								
Harmony	1,957	243	1,984	254	2,024	269	2,077	281
Panama								
Kiantone	1,364	480	1,397	501	1,425	516	1,463	539
Mina	1,150	1,306	1,188	1,365	1,212	1,407	1,244	1,470
North Harmony	2,311	3,161	2,411	3,303	2,461	3,405	2,525	3,556
Poland	2,360	606	2,451	633	2,511	653	2,567	682
Pomfret	14,018	2,320	14,199	2,425	14,491	2,498	14,873	2,612
Fredonia								
Portland	3,871	2,226	3,983	2,327	4,065	2,400	4,172	2,505
Brocton								
Ripley	2,987	1,555	3,029	1,626	3,091	1,676	3,172	1,751
Ripley								
Sheridan	2,573	1,103	2,660	1,153	2,714	1,189	2,785	1,241
Sherman	1,454	153	1,474	160	1,505	166	1,544	173
Sherman								
Stockton	2,253	354	2,379	360	2,387	372	2,460	388
Cassadaga								
Villanova	988	183	1,001	192	1,022	187	1,048	206
Westfield	5,295	2,226	5,421	2,327	5,533	2,400	5,679	2,506
Westfield								
Chautauqua County	149,410	37,763	153,247	39,473	155,731	40,700	159,936	42,500

TABLE 2-8

WASTE GENERATION SUMMARY BY MUNICIPALITY
POUNDS PER CAPITA PER SURVEY DAY
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

(Based on Field Survey Data)

Municipality	Average Daily Solid Waste Generation Per Survey Day (Tons)	Average Daily Solid Waste Generation Per Survey Day (Lbs.)	1975 Permanent Population	Waste Generation Pounds Per Capita Per Survey Day (a): Household and Commercial	Waste Generation Pounds Per Capita Per Survey Day (a): All Wastes
Dunkirk	235.5	471,000	18,737	9.60	25.13
Jamestown	106.25	212,500	40,161	5.23	5.29
Arkwright	*	*	848	*	*
Busti	2.71		8,520		
Lakewood	3.46				
Total	6.17	12,340	8,520	1.45	1.45
Carrol			3,172		
Frewsburg	0.95				
Total	0.95	1,900	3,172	0.60	0.60
Charlotte			1,425		
Sinclairville	3.06				
Total	3.06	6,120	1,425	3.06	4.29
Chautauqua			4,420		
Mayville	0.08				
Total	C.08	160	4,420	0	0.04
Cherry Creek	.09	180	1,161	0.16	0.16
Clymer	*		1,377	*	*

TABLE 2-8 (Continued)

Municipality	Average Daily Solid Waste Generation Per Survey Day (Tons)	Average Daily Solid Waste Generation Per Survey Day (Lbs.)	1975 Permanent Population	Waste Generation Pounds Per Capita Per Survey Day (a) Household and Commercial	Waste Generation Pounds Per Capita Per Survey Day (a) All Wastes
Ellery	2.44		4,678		
Bemus Point	3.69				
Maple Springs	0.02				
Total	6.13	12,260	4,678	1.68	2.62
Ellicott	1.48		10,420		
Fluvanna	0.28				
Ross Mills	0.04				
Celoron	1.10				
Falconer	19.34				
Total	22.24	44,480	10,420	3.05	4.27
Ellington	0.36	720	1,409	0.27	0.51
French Creek	*		863	*	*
Gerry	1.54		1,666		
Sinclairville	0.50				
Total	2.40	4,080	1,666	2.00	2.45
Hanover	0.43		7,972		
Forestville	0.83				
Silver Creek	6.08				
Total	7.34	14,680	7,972	1.73	1.84
Harmony			1,967		
Panama	0.43				
Total	0.43	860	1,967	0.44	0.44
Kiantone	*		1,364	*	*
Mina	*		1,150	*	*
North Harmony	*		2,311	*	*

TABLE 2-8 (Continued)

Municipality	Average Daily Solid Waste Generation Per Survey Day (Tons)	Average Daily Solid Waste Generation Per Survey Day (Lbs.)	1975 Permanent Population	Waste Generation Pounds Per Capita Per Survey Day (a) Household and Commercial	Waste Generation Pounds Per Capita Per Survey Day (a) All Wastes
Poland			2,360		
Kennedy	1.28				
Total	1.28	2,560	2,360	0.74	1.08
Pomfret	0.02		14,018		
Fredonia	55.95				
Laona	0.02				
State University	1.78				
Total	57.87	115,740	14,018	5.84	8.26
Portland	0.15		3,871		
Brockton	2.04				
Total	2.19	4,380	3,871	1.13	1.13
Ripley	*		2,987	*	*
Sheridan	1.97	3,940	2,573	0.85	1.53
Sherman	*		1,454	*	*
Stockton	2.60		2,253		
Cassagada	4.02				
Total	6.62	13,240	2,253	4.15	5.88
Villanova	*		988	*	*
Westfield	3.12	6,240	5,295	1.15	1.18

(a) Waste locational assignment to municipalities was based on information from individuals delivering the wastes to the Landfill Sites.

* No waste was delivered to either the Stockton or Dunkirk Landfill Sites during the Survey Period.

TABLE 2-9

SUMMARY PER CAPITA WASTE GENERATION(a)
CHAUTAUQUA COUNTY, NEW YORK

	Waste Category	Field Survey At Stockton-Dunkirk Landfills April 28 through May 9, 1975	Havens & Emerson 1971 Solid Waste Report Projection for 1975	Summer Seasonal Waste Generation Rates(e) 1975	Adjusted Waste Generation Rates(f) 1975
		POUNDS PER CAPITA PER DAY(a)			
(1)	Residential and Commercial	3.95	3.96	2.10	4.0
(2)	Yard Cleanup	0.54	0.20	-	0.2
(3)	Industrial	1.08	3.70(c)	-	4.06
(4)	Demolition	0.68(b)	(d)	-	-(g)
	TOTAL	6.25(i)	7.86(h)	2.10	8.26(i)

(a) Waste generation based on a 6 day week.

(b) Due tc Urban Renewal in Dunkirk.

(c) Does not include ash generated at electric utilities.

(d) No projection given.

(e) Based on Havens and Emerson 1971 Report projections for 1975; 3 months per year, during the summer.

(f) Adjustments made to account for the areas of the County in which NO WASTES or low waste quantities were recorded during the field survey.

(g) Since the urban renewal project is near completion, it can be assumed that relatively small quantities of demolition wastes will be generated in the future.

(h) Based on Population Projections in the 1971 Havens and Emerson Report for 1975 at 172,250.

(i) Based on Revised Population projections provided by Chautauqua County at 149,410.

To develop a revised residential and commercial per-capita rate, an analysis was made of those Communities which had contributed no wastes during the 11 day survey period, and also of the Communities that contributed more as well as less than 3.95 pounds per-capita per day, as indicated in Table 2-8. A population was determined for each set of communities generating (1) no wastes, (2) more than 3.95 pounds per-capita per day and (3) less than 3.95 pounds per-capita per day. The 1975 population of Chautauqua County was projected at 149,410 people, which yielded 295 tons of waste per day at 3.95 pounds per-capita per day for residential and commercial wastes. Computing the population not generating any wastes, or less than 3.95 pounds per-capita per day, during the survey period and comparing the population that generated more than the 3.95 pound daily rate yielded a deficiency of approximately 2300 persons not contributing to the wastes recorded during the survey period. Extrapolating from this resulted in the adjusted residential and commercial per-capita waste generation rate of 4.0 pounds per day.

The industrial per-capita waste generation rate was adjusted upward from the 1971 Havens and Emerson report, consistent with the adjusted waste projections given in Table 2-4, Industrial Solid Waste Generation. Yard wastes were retained at 0.2 pounds per-capita per day. Demolition wastes were assumed, for the future, to be included principally in the residential and commercial wastes. The current urban renewal project in Dunkirk and any such special future projects would have to have the per-capita impact assessed specifically to the project. Seasonal summer waste generation rates were based on a three-month-per-year generating period at a rate of 2.1 pounds per seasonal capita per day. The fourth column of Table 2-9 reflects the adjusted per-capita waste generation rate for Chautauqua County.

Total solid waste quantities were projected by municipality for 1975, 1985 and 2010, Tables 2-10A, B and C. The residential, commercial and summer seasonal per-capita waste generation rates were increased annually from 1975 to 1980 at two percent and kept constant from 1980 to 2010. This results in a 1980 daily residential and commercial per-capita waste generation rate of 4.44 pounds. Industrial waste quantities were held constant throughout the period. Since the industrial sector has an increasing awaremess of recycling waste materials, the lesser amount of industrial wastes generated over future years should be compensated for by new industries locating in the area. Therefore, significant increases in industrial waste generation are not anticipated. Flyash and bottom ash from electric utility stations were not included in the projected industrial waste quantities. The total annual projected solid waste quantities generated in Chautauqua during 1975, 1985, and 2010 were projected to be 192,100 tons, 204,700 tons and 210,000 tons, respectively.

To delineate the available combustible and non-combustible constituents in the annual quantity of solid wastes generated, a summary of expected waste components for residential and commercial and industrial solid wastes was developed in Tables 2-11A, B and C. The individual waste component percentages for residential and commercial wastes were determined from the waste categorization field sampling program. The adjusted waste component

TABLE 2-10A

1975 - TOTAL SOLID WASTE QUANTITY PROJECTIONS BY MUNICIPALITY(a) CHAUTAUQUA COUNTY, NEW YORK

WASTE QUANTITIES

Municipality	Permanent Population	Summer Seasonal Population	Industrial	Total
	- - - - - - - - - -	TONS PER YEAR	- - - - - - - - - -	
Dunkirk	10,667	86	38,000	48,753
Jamestown	25,185	28	17,066	42,279
Arkwright	531	28	-	559
Busti	5,343	197	686	6,226
Carroll	1,989	41	1,685	3,715
Charlotte	894	19	44	957
Chautauqua	2,772	645	3,950	7,367
Cherry Creek	728	16	-	744
Clymer	864	3	1,788	2,655
Dunkirk	1,083	90	(b)	1,173
Ellery	2,934	488	-	3,422
Ellicott	6,534	16	14,224	20,774
Ellington	884	28	1,429	2,341
French Creek	541	17	-	558
Gerry	1,045	25	1	1,071
Hanover	4,999	337	1,020	6,356
Harmony	1,234	23	59	1,316
Kiantone	855	45	13	913
Mina	721	123	-	844
North Harmony	1,449	229	-	1,748
Poland	1,480	57	-	1,537
Pomfret	8,791	219	3,120	12,130
Portland	2,428	210	-	2,638
Ripley	1,873	147	119	2,139
Sheridan	1,614	104	128	1,846
Sherman	912	15	2,140	3,067
Stockton	1,413	33	34	1,480
Villanova	619	17	-	636
Westfield	3,320	210	9,298	12,828
	93,702	3,566	94,804	192,072

(a) Residential and Commercial wastes, under permanent and seasonal population were increased at an annual rate of two percent to 1980 and kept constant until 2010. Industrial wastes were held constant throughout the period.

(b) Industrial wastes for the town of Dunkirk are included in the City of Dunkirk industrial wastes.

TABLE 2-10B

1985 - TOTAL SOLID WASTE QUANTITY PROJECTIONS BY MUNICIPALITY[a]
CHAUTAUQUA COUNTY, NEW YORK

WASTE QUANTITIES

Municipality	Permanent Population	Summer Seasonal Population	Industrial	Total
	TONS PER YEAR			
Dunkirk	11,933	99	38,000	50,032
Jamestown	28,174	33	17,066	45,273
Arkwright	596	32	-	628
Busti	6,116	228	686	7,030
Carroll	2,277	47	1,685	4,009
Charlotte	1,024	22	44	1,090
Chautauqua	3,172	745	3,950	7,867
Cherry Creek	815	18	-	833
Clymer	966	3	1,788	2,757
Dunkirk	1,248	104	(b)	1,352
Ellery	3,378	563	-	3,941
Ellicott	7,402	19	14,224	21,645
Ellington	990	33	1,429	2,452
French Creek	618	20	-	638
Gerry	1,193	29	1	1,223
Hanover	5,708	389	1,020	7,117
Harmony	1,374	27	59	1,460
Kiantone	967	52	13	1,032
Mina	823	142	-	965
North Harmony	1,670	345	-	2,015
Poland	1,698	66	-	1,764
Pomfret	9,834	253	3,120	13,207
Portland	2,759	243	-	3,002
Ripley	2,098	170	119	2,837
Sheridan	1,842	120	128	2,090
Sherman	1,020	17	2,140	3,177
Stockton	1,648	38	34	1,720
Villanova	693	20	-	713
Westfield	3,755	243	9,298	13,296
	105,791	4,120	94,804	204,715

(a) Residential and Commercial wastes, under permanent and seasonal population were increased at an annual rate of two percent to 1980 and kept constant until 2010. Industrial wastes were held constant throughout the period.

(b) Industrial wastes for the town of Dunkirk are included in the City of Dunkirk industrial wastes.

TABLE 2-10C

2010 - TOTAL SOLID WASTE QUANTITY PROJECTIONS BY MUNICIPALITY(a)
CHAUTAUQUA COUNTY, NEW YORK

WASTE QUANTITIES

Municipality	Permanent Population	Summer Seasonal Population	Industrial	Total
	- - - - - - - - - - TONS PER YEAR			- - - - - - - - - -
Dunkirk	12,500	110	38,000	50,610
Jamestown	29,512	35	17,066	46,613
Arkwright	624	35	-	659
Busti	6,407	245	686	7,338
Carroll	2,385	51	1,685	4,121
Charlotte	1,071	24	44	1,139
Chautauqua	3,324	802	3,950	8,076
Cherry Creek	854	19	-	873
Clymer	1,013	4	1,788	2,805
Dunkirk	1,308	111	(b)	1,419
Ellery	3,538	606	-	4,144
Ellicott	7,739	20	14,224	21,983
Ellington	1,036	35	1,429	2,500
French Creek	647	21	-	668
Gerry	1,249	32	1	1,282
Hanover	5,978	419	1,020	7,417
Harmony	1,439	29	59	1,527
Kiantone	1,013	56	13	1,082
Mina	862	153	-	1,015
North Harmony	1,749	371	-	2,120
Poland	1,778	71	-	1,849
Pomfret	10,300	272	3,120	13,692
Portland	2,890	261	-	3,151
Ripley	2,197	183	119	2,499
Sheridan	1,928	129	128	2,185
Sherman	1,070	18	2,140	3,228
Stockton	1,704	41	34	1,779
Villanova	726	22	-	748
Westfield	3,933	261	9,298	13,492
	110,774	4,436	94,804	210,014

(a) Residential and Commercial wastes, under permanent and seasonal population were increased at an annual rate of two percent to 1980 and kept constant until 2010. Industrial wastes were held constant throughout the period.

(b) Industrial wastes for the town of Dunkirk are included in the City of Dunkirk industrial wastes.

TABLE 2-11A

1975 - WASTE COMPONENT QUANTITY SUMMARY PROJECTIONS CHAUTAUQUA COUNTY, NEW YORK

Waste Component	Residential & Commercial	Industrial	Totals
	- - TONS PER YEAR - -		
Paper	39,879	8,440	48,319
Plastic	3,502	95	3,597
Rubber/Leather	584	-	584
Textiles	3,113	284	3,397
Wood	876	10,144	11,020
Food Wastes	16,243	3,792	20,035
Yard Wastes	6,031	-	6,031
Miscellaneous	5,933	-	5,933
Combustible Waste Subtotal	76,161	22,755	98,916
Ferrous Metal	4,572	18,676	23,248
Non Ferrous Metal	3,598	4,645	8,243
Glass	11,673	1,990	13,663
Ashes, Rock, Dirt	1,264	46,738	48,002
Non Combustible Waste Subtotal	21,107	72,049	93,156
TOTAL	97,268	94,804	192,072

NOTE: Industrial Wastes do not include electric utility station ash.

TABLE 2-11B

1985 - WASTE COMPONENT QUANTITY SUMMARY PROJECTIONS
CHAUTAUQUA COUNTY, NEW YORK

Waste Component	Residential & Commercial	Industrial	Totals
	- - TONS PER YEAR - -		
Paper	45,064	8,440	53,504
Plastic	3,957	95	4,052
Rubber/Leather	659	-	659
Textiles	3,518	284	3,802
Wood	989	10,144	11,133
Food Wastes	18,355	3,792	22,147
Yard Wastes	6,815	-	6,815
Miscellaneous	6,704	-	6,704
Combustible Waste Subtotal	86,061	22,755	108,816
Ferrous Metal	5,166	18,676	23,842
Non Ferrous Metal	4,067	4,645	8,712
Glass	13,189	1,990	15,179
Ashes, Rock, Dirt	1,428	46,738	48,166
Non Combustible Waste Subtotal	23,850	72,049	95,899
TOTAL	109,911	94,804	204,715

NOTE: Industrial Wastes do not include electric utility station ash.

TABLE 2-11C

2010 - WASTE COMPONENT QUANTITY SUMMARY PROJECTIONS
CHAUTAUQUA COUNTY, NEW YORK

Waste Component	Residential & Commercial	Industrial	Totals
	- - TONS PER YEAR - -		
Paper	47,237	8,440	55,677
Plastic	4,148	95	4,243
Rubber/Leather	692	-	692
Textiles	3,687	284	3,971
Wood	1,036	10,144	11,180
Food Wastes	19,240	3,792	23,032
Yard Wastes	7,143	-	7,143
Miscellaneous	7,027	-	7,027
Combustible Waste Subtotal	90,210	22,755	112,965
Ferrous Metal	5,415	18,676	24,091
Non Ferrous Metal	4,263	4,645	8,908
Glass	13,825	1,990	15,815
Ashes, Rock, Dirt	1,497	46,738	48,235
Non Combustible Waste Subtotal	25,000	72,049	97,049
TOTAL	115,210	94,804	210,014

NOTE: Industrial Wastes do not include electric utility station ash.

percentages for residential and commercial wastes given in Table 2-6, Composite Solid Waste Categorization Sample, were used to determine the individual waste component quantities. Therefore, for 1975 it is estimated that approximately 76,200 tons of combustible wastes and 21,100 tons of non-combustible Residential and Commercial wastes will be generated. The waste component distribution for industrial wastes was based on information from the 1971 Havens and Emerson Report. Types of industrial wastes disposed of "off premises" were given and projection estimates were made, based on wastes generated per employee for each industrial classification. The percent composition of the industrial wastes used in each of these tables is shown in Table 2-12, Estimated Percent Composition of Industrial Wastes. These industrial component percentages were used for the entire period examined, 1975, 1985 and 2010. Significant changes in the industrial waste composition could occur by industry, either changing or improving production methods and reducing wastes, by new industry coming into the area that might have different wastes, or by existing industry closing facilities in the area. Assuming that the same industries are generating wastes throughout the period examined, a possible variation that could be expected is the displacement of wood and metals by increasing use of synthetic substitutes. It would be impossible to determine and project the magnitude of this displacement by synthetics on industrial wastes; it should, however, be noted. It is estimated, therefore, that approximately 22,800 tons per year of combustible and 72,000 tons of non-combustible industrial wastes will be generated in 1975. The non-combustible industrial wastes do not include flyash from electric utility stations.

For use as a possible fuel source, the potential energy value of the wastes must be examined. Table 2-13 provides typical energy and moisture values in the waste components of Chautauqua County solid wastes.

The typical high heating values (HHV), dry basis, expressed in BTU(a) per pound of waste material, range between 200 BTU per pound for non-combustibles to 14,600 BTU per pound for plastics. The average moisture value ranges from 2 to 60 percent by weight. These typical values were drawn from Gilbert Associates Laboratory Studies on refuse samples and other pertinent state-of-the-art literature sources.

It is necessary to delineate probable types of waste-generating source schemes so that available energy from each source scheme could be included in subsequent considerations of the applicable waste energy utilization systems. To obtain the potential energy available for any waste energy source scheme, the relative percentage for each source of the wastes as generated was extrapolated. The wastes generated are by weight, and for various municipal-industrial combustible - non-combustible schemes in Chautauqua County. Table 2-14 lists the various source schemes and associated waste component percentages. These percentages were derived from Table 2-11, which provides a waste component weight for combustible - non-combustible wastes, Residential-Commercial or "Municipal" wastes, and Industrial wastes. From Tables 2-11A, B, and C, the annual Waste Component Quantity Summary Projections were expanded to include daily and hourly average waste flow rates for source schemes. The annual, daily and hourly

(a) BTU - British Thermal Unit

TABLE 2-12

ESTIMATED PERCENT COMPOSITION OF INDUSTRIAL WASTES CHAUTAUQUA COUNTY, NEW YORK

Paper	8.9%
Wood	10.7%
Textiles	0.3%
Plastics	0.1%
Food Wastes	4.0%
Ferrous Metal	19.7%
Non Ferrous Metal	4.9%
Glass	2.1%
Sand/Ash	49.3%

TABLE 2-13

TYPICAL ENERGY AND MOISTURE VALUES OF WASTE COMPONENTS FOR CHAUTAUQUA COUNTY SOLID WASTES

	Waste Component	High Heating Value HHV - Dry (BTU/Lb)	Average Moisture Value (%)
1.	Paper	7,900	15
2.	Plastic	14,600	2
3.	Rubber/leather	9,800	5
4.	Textiles	8,000	5
5.	Wood	8,500	10
6.	Food Wastes	8,400	60
7.	Yard Wastes	7,300	30
8.	Miscellaneous	6,000	45
9.	Non-Combustibles (metals, glass, ash, etc.)	200	2

TABLE 2-14

ESTIMATED SOURCE SCHEMES SOLID WASTE COMPOSITION BY WEIGHT PERCENT CHAUTAUQUA COUNTY, NEW YORK

Waste Components	Municipal Combustible and Non-Combustible Wastes (MMR) (a)	Municipal Combustible Wastes Only	Municipal/Industrial Combustible Wastes Only	Municipal/Industrial Combustibles And Non-Combustbles Wastes	Municipal Combustible and Non-Combustible Wastes and Industrial Combustible Wastes Only
Paper	41.0	52.4	48.9	25.3	40.3
Plastic	3.6	4.6	3.6	1.9	3.0
Rubber/Leather	0.6	0.8	0.6	0.3	0.5
Textiles	3.2	4.1	3.4	1.8	2.8
Wood	0.9	1.2	11.1	5.8	9.2
Food Wastes	16.7	21.2	20.3	10.5	16.7
Yard Wastes	6.2	7.9	6.1	3.1	5.0
Miscellaneous	6.1	7.8	6.0	2.8	4.9
Non-Combustible	21.7	-	-	48.5	17.6
	100	100	100	100	100

(a) MMR abbreviates mixed municipal refuse, the type of wastes currently generated in Chautauqua County.

waste flow rates are given in Table 2-15. Daily waste flow rates were based on a six-day waste generating week or 312 waste generating days per year. The hourly waste flow rate was based on 12 hours per day, the daily operating time for a waste-processing facility. An important design consideration for such a facility is peak and minimum waste flows expected at the waste-processing facility. Based on the field survey data recorded during April 28 through May 9, 1975 and compiled in Table 2-1, Summary of Daily Incoming Solid Wastes, there is a significant difference in peak and minimum waste loads when compared to the daily average waste load. Accordingly, the combined peak waste load for the Stockton and Dunkirk landfill was 51% above the combined daily average waste load, and the combined minimum waste load was 45% below the combined daily average waste load. Therefore, adequate capacity to handle peak waste loads at a waste processing facility will be considered.

From Tables 2-13 and 2-15, a composite energy value - HHV(a) dry was derived for the waste components, along with a composite moisture value and a moisture-adjusted composite HHV energy value. These values are given in Table 2-16 along with the associated source schemes. Also developed in Table 2-16 is the total annual and daily inherent energy potential on a moisture-adjusted basis, for various source schemes from Chautauqua County wastes, in billion BTU. The inherent energy potential should not be misinterpreted by examining which source scheme merely provides the highest potential energy. The quantity and type of wastes to be processed are also important, as given in Table 2-15. For example, Source Scheme 4, municipal/industrial combustible and non-combustible wastes, provides the greatest inherent energy potential of all the source schemes. When compared, however, to Source Scheme 5, municipal combustible and non-combustible and industrial combustible wastes, Source Scheme 4 requires the processing of 38% more wastes, by weight, than Source Scheme 5, but will only generate 14% more energy potential than Source Scheme 5.

(a) High heating value

TABLE 2-15

TOTAL PROJECTED AVERAGE WASTE QUANTITIES FOR SOURCE SCHEMES[a]
CHAUTAUQUA COUNTY, NEW YORK

		1975 WASTE QUANTITIES			1985 WASTE QUANTITIES			2010 WASTE QUANTITIES		
		Year	Day[b]	Hour[c]	Year	Day[b]	Hour[c]	Year	Day[b]	Hour[c]
		- - - - - TONS - - - - -			- - - - - TONS - - - - -			- - - - - TONS - - - - -		
1.	Municipal Combustible and Non-Combustible Wastes (MMR) (d)	97,300	310	26	109,900	350	29	115,200	370	31
2.	Municipal Combustible Wastes Only	76,200	240	20	86,100	280	23	90,200	290	24
3.	Municipal/Industrial Combustible Wastes Only	98,900	320	27	108,800	350	29	113,000	360	30
4.	Municipal/Industrial Combustible and Non-Combustible Wastes	192,100	620	52	204,700	660	55	210,000	670	56
5.	Municipal Combustible and Non-Combustible Wastes and Industrial Combustible Wastes Only	120,000	390	33	132,700	430	36	138,000	440	37

(a) Peak and minimum, daily and hourly waste loads will occur. According to the field survey data in Table 2-1, the combined peak waste load for the Stockton and Dunkirk landfill was 51% above the combined daily average waste load and the combined minimum waste load was 45% below the combined daily average waste load.

(b) Based on wastes delivered to the processing facility 6 days per week, 312 days per year.

(c) Based on a 12 hour per day waste processing facility operation.

(d) MMR - Mixed Municipal Refuse

TABLE 2-16

ESTIMATED GROSS INHERENT ENERGY POTENTIAL FROM CHAUTAUQUA COUNTY WASTES

	Composite Energy Value - HHV Dry (BTU/LB)	Composite Moisture Value (%)	Composite Moisture HHV Energy Value(c) (BTU/LB)	Total Annual Inherent Energy Potential On A Moisture Adjusted Basis(a) 1975	1985	2010	Total Daily Inherent Energy Potential On a Moisture Adjusted Basis(b) 1975	1985	2010
				- - - -BILLION BTU's- - - - -			- - - -BILLION BTU's- - - -		
1. Municipal Combustible and Non-Combustible Wastes (MMR)	6,240	22	5,000	973	1,099	1,152	3.1	3.5	3.7
2. Municipal Combustible Wastes Only	8,150	27	5,950	907	1,025	1,073	2.9	3.3	3.4
3. Municipal/Industrial Combustible Wastes Only	8,170	25	6,130	1,213	1,334	1,385	3.9	4.3	4.4
4. Municipal/Industrial Combustible and Non-Combustible Wastes	4,315	13	3,750	1,441	1,535	1,575	4.6	4.9	5.1
5. Municipal Combustible and Non-Combustible Wastes and Industrial Combustible Wastes Only	6,570	21	5,190	1,246	1,377	1,432	4.0	4.4	4.6

(a) Waste quantities used to develop energy potentials are given in Table 2-15, Total Projected Average Waste Quantities for Source Schemes.

(b) Based on a 6 day week, 312 days per year.

(c) HHV - High Heating Value.

CHAPTER 3

POTENTIAL MARKETS FOR ENERGY AND MATERIALS RECOVERY

SOLID WASTE MATERIALS RECOVERY MARKET STUDY

OBJECTIVE

The objective of this phase of the report was to perform a preliminary evaluation of the market potential of various components of municipal solid wastes. The specific solid waste components which were treated are textiles, paper, rubber and plastic, glass, and ferrous and non-ferrous metals. This study considers a region consisting of Chautauqua County, New York and those other New York and Pennsylvania Counties which are situated roughly within a 100-mile radius of Chautauqua County. The counties considered, their 1970 populations, and their average distance from Chautauqua County are presented in Appendix C, Exhibit 1. All exhibits for the "Materials Recovery Market Study" of Chapter 3 will be contained in Appendix C-1.

APPROACH AND METHODOLOGY

The ultimate market potential for any component of municipal solid waste is a function of two major factors: (1) the presence of suitable types of manufacturing operations within economic distances of the municipal solid waste recovery plant and (2) the willingness on the part of these manufacturers to accept components of municipal solid waste as input into their processes. The approach and methodology employed in this market analysis was designed to allow for a preliminary evaluation of each of these two basic market factors.

The first step of the study consisted of a "broadbrush" review of the region in and around Chautauqua County for the purpose of measuring both the level and the geographical distribution of manufacturing activity in a number of key industries. The industries judged to have particular market relevancy for municipal solid wastes are: primary metals, paper and allied products, rubber and miscellaneous plastic products, and glass products. This initial review was conducted primarily by means of literature research of various industrial and trade directories. Exhibit 29 of this report lists the major information sources which were used for the regional review of manufacturing activity.

The second step in this preliminary market investigation was aimed at obtaining a measure of the degree to which manufacturers currently use various types of secondary materials and also, and more importantly, the degree to which these manufacturers would consider utilizing additional quantities at some future date. Using the information compiled in the initial review of manufacturing activity, a number of specific manufacturers were selected for inclusion in a mail survey. The criteria employed for selecting a particular manufacturer were product line, geographic location, and company size, as measured by number of employees.

The survey form was designed to yield information pertaining to the following points of interest:

1. type and quantity of secondary material presently being utilized;
2. sources of secondary materials;
3. type and quantity of additional material which the manufacturer would be interested in obtaining in the future;
4. nature of any physical, economic or other constraints which bear upon the manufacturer's ability to utilize various types of secondary materials.

The results obtained were used to identify specific companies which may merit further and more detailed investigation at a subsequent date.

In parallel to the efforts which were directed at manufacturers, investigation was also made into the receptiveness of the secondary material industry to accept various components of municipal solid waste. When considering the channels through which secondary materials flow, the historic function of the secondary materials industry has been to provide points at which materials could be received, sorted, concentrated and stored before shipment to manufacturers. As such, the secondary material dealer, while he does not constitute the ultimate market, does, however, serve as a gateway to that market. His willingness and/or ability to accept additional quantities of various materials is viewed as a reflection of the market's ability to absorb additional materials.

In view of their historic role and their considerable experience with secondary material markets, a number of dealers within the region were contacted and queried as to their level of interest in receiving various components of municipal solid waste. As with the survey of manufacturers, the ultimate aim of this effort was to identify specific dealers who merit further and more intensive contact. Information sources used to identify secondary material dealers are listed in Exhibit 29.

REGIONAL PROFILE OF MANUFACTURERS

Research was conducted to define the overall level and geographic distribution of manufacturing activity within five major industries located within those New York and Pennsylvania counties which are roughly within a 100-mile radius of Chautauqua County, New York. The five industries considered were:

Textiles	SIC 22XX(a)
Paper and Allied Products	SIC 26XX
Rubber & Miscellaneous Plastic Products	SIC 30XX
Stone, Clay and Glass Products	SIC 32XX
Primary Metal Industries	SIC 33XX

(a) SIC - Standard Industrial Classification

It should be noted that while each of the above listed major two-digit SIC industries was considered, not all sub-classifications under each two-digit code were considered applicable to the study. Exhibit 2 of this report lists the specific SIC sub-classifications which were considered, and all exhibits and statistics which follow relate only to those specific SIC sub-classifications.

In addition to Chautauqua County, New York, the region considered contains nine New York and ten Pennsylvania counties. As of the 1970 U. S. Census of Population, the area contained approximately 2.6 million people.

Tabulated in Exhibits 3 through 7 are the detailed results of this initial review of regional manufacturing activity. As can be discerned from these exhibits, which the exception of the 22XX industry, the other four industries considered are well represented within the region. Presented in Table 3-1 below is a summary of the region's manufacturing profile by major industry group.

TABLE 3-1

REGIONAL PROFILE OF MANUFACTURERS
(By Industry Group)

INDUSTRY GROUP (SIC)	NUMBER OF COMPANIES IDENTIFIED	NUMBER OF EMPLOYEES	NUMBER OF EMPLOYEES PER COMPANY
22XX - Textiles	4	174	44
26XX - Paper, et. al.	35	3,275	94
30XX - Rubber & Misc. Plastics	76	10,795	142
32XX - Stone, Clay, Glass	44	3,753	85
33XX - Primary Metals	86	38,883	452

In attempting to define levels of manufacturing activity by industry group, there exists the problem of selecting an appropriate unit of measure. Examples of possible "measuring sticks" are: total number of companies, total quantity of raw material input, total dollar value added, total units of product output, total number of employees, or average company size as measured by number of employees. Based primarily on data availability considerations, the total number of employees was selected as a rough indicator of the level of manufacturing activity within each of the industries considered. Exhibits 8 through 12 present profiles of the relative geographic distribution by county of the total number of employees engaged in each of the five major industries. It can be seen that the distribution of manufacturing activity (as measured by the total number of employees) is not uniform, with some counties supporting considerably more activity than others. Table 3-2 below presents a ranking of the top five counties which contain the greatest total number of employees in each industry group.

TABLE 3-2

COUNTY RANKING BY TOTAL EMPLOYEES AND INDUSTRY GROUP

SIC 22XX - Textiles
- Erie, New York
- Chautauqua, New York
- Niagara, New York

SIC 26XX - Paper, et. al.
- Erie, New York
- McKean, Pennsylvania
- Steuben, New York
- Genesee, New York

SIC 30XX - Rubber & Misc. Plastics
- Erie, Pennsylvania
- Erie, New York
- Warren, Pennsylvania
- Crawford, Pennsylvania
- Niagara, New York

SIC 32XX - Stone, Clay, Glass
- Erie, New York
- Crawford, Pennsylvania
- McKean, Pennsylvania
- Cattaraugus, New York
- Forest, Pennsylvania

SIC 33XX - Primary Metals
- Erie, New York
- Mercer, Pennsylvania
- Chautauqua, New York
- Erie, Pennsylvania
- Niagara, New York

It is also of interest to ascertain the degree of concentration of industrial activity within each county. For example, the question arises whether Erie County, New York ranks number one in the primary metal industries because it has a small number of very large manufacturers or a large number of relatively small operations. In an attempt to provide some insight into the average size of companies in one county relative to another county, Exhibits 3 through 7 also present the average number of employees per company for those companies which were identified within each county.

Based upon the measure of average number of employees per company, Table 3-3, following, presents the relative ranking of the top five counties which, on an average, contain the largest manufacturers within a particular industry group.

TABLE 3-3

COUNTY RANKING BY AVERAGE NUMBER OF EMPLOYEES AND INDUSTRY GROUP

SIC 22XX - Textiles
Erie, New York
Chautauqua, New York
Niagara, New York

SIC 26XX - Paper, et. al.
Steuben, New York
McKean, Pennsylvania
Erie, New York
Erie, Pennsylvania
Genesee, New York

SIC 30XX - Rubber & Misc. Plastics
Warren, Pennsylvania
Genesee, New York
Erie, New York
Forest, Pennsylvania
Erie, Pennsylvania

SIC 32XX - Stone, Clay, Glass
Forest, Pennsylvania
Cattaraugus, New York
Crawford, Pennsylvania
McKean, Pennsylvania
Chautauqua, New York

SIC 33XX - Primary Metals
Mercer, Pennsylvania
Erie, New York
Genesee, New York
Crawford, Pennsylvania
Chautauqua, New York

MARKET SURVEY

A. Sample Surveyed

1. Manufacturers - Out of the 245 individual manufacturers identified in the regional market review, 125 companies were selected for mail survey. The selection of a particular company was based primarily upon three factors: company location, company product line, and company size as measured by number of employees. Table 3-4 below indicates the number of companies within each industrial group which were included in the sample surveyed.

TABLE 3-4

SURVEY OF MANUFACTURERS - SAMPLE COMPOSITION

SIC	NUMBER OF COMPANIES
22XX - Textiles	4
26XX - Paper, et. al.	19
30XX - Rubber & Misc. Plastics	28
32XX - Stone, Clay, Glass	20
33XX - Primary Metals	54
TOTAL	125

The names and addresses of all 125 companies surveyed are listed in Appendix C-2 of this report.

Exhibits 13 and 14 present copies of the cover letter and the survey from which were mailed to each of the 125 manufacturers.

2. Secondary Material Dealers - A sample of 54 New York, Pennsylvania and Ohio secondary material dealers were selected for mail survey. Dealer selection was based primarily upon geographical location and also upon the types of materials which the various dealers emphasized in their advertisements. The resulting sample included a number of dealers who advertised for each of the following types of material: scrap metal (ferrous and non-ferrous), waste paper, scrap plastic and scrap rubber.

   The names and addresses of each dealer included in the sample surveyed are contained in Appendix C-3 of this report. Exhibit 15 presents the letter of inquiry which was sent to each of the 54 secondary material dealers.

B. Survey Response

1. Manufacturers - Exhibit 16 provides a tabulation of the response to the survey of manufacturers. In general, the overall response was good, with approximately 32 percent of the survey forms being returned. Comparing New York with Pennsylvania, approximately 33 percent of the New York manufacturers contacted completed and returned their survey forms and 27 percent of the manufacturers in Pennsylvania responded. Chautauqua County manufacturers responded well to the inquiry with an overall response rate of 59 percent.

   In terms of response by industry group, the best response, as measured by the percentage of survey forms returned, was from manufacturers classified under SIC's 22XX-Textiles, 26XX-Paper et. al., and 32XX-Stone, Clay, Glass. Fifty percent, 47 percent and 45 percent respectively, of these manufacturers responded to the study. Of those firms classified under 33XX, the response was 28 percent. The lowest response rate was obtained from manufacturing firms classified under SIC 30XX, with only 18 percent returning the survey forms.

2. Secondary Material Dealers - As of this writing, the reaction of the various secondary material dealers contacted must be labeled as relatively unresponsive. Of the 54 letters of inquiry which were mailed to the secondary material dealers, only five responses were obtained.

   In judging the response rate of the secondary material dealers contacted, it should be noted that a number of dealers contacted had ceased to engage in the scrap business. It should also be noted that letters of inquiry and rather comprehensive survey questionnaires were sent to each dealer. These two factors, combined, perhaps had a negative effect upon meeting the response date.

C. Survey Results

1. Present Material Utilization - Exhibits 17 and 18 present the results obtained from the survey of 125 manufacturing firms. As previously stated, one of the basic aims of the survey was to obtain information regarding usage of secondary materials by material type and amount. This issue was addressed in Survey Question 1a. which asked respondents to indicate by a "yes" or "no" whether they presently use some type of secondary material in their operation. Table 3-5 below, summarizes, by major industry group, the number of positive responses to Question 1a.

TABLE 3-5

PRESENT SECONDARY MATERIAL UTILIZATION

INDUSTRY GROUP	"YES" RESPONSE TO QUESTION 1a.	% OF TOTAL RESPONSES
22XX - Textiles	2	100%
26XX - Paper, et. al.	4	44
30XX - Rubber & Misc. Plastics	1	20
32XX - Stone, Clay, Glass	3	33
33XX - Primary Metals	12	80

Of the companies responding to the survey, a total of 22, or 55 percent indicated that they do currently use some form of secondary material. Furthermore, all industry groups indicated some degree of secondary material utilization. Table 3-6 below summarizes, by material type, the respondents' estimates of quantities consumed.

TABLE 3-6

SECONDARY MATERIAL CURRENTLY USED

TYPE OF MATERIAL	TONS/YEAR
Mixed Rags and Other Natural & Synthetic Fibers	22,500
Waste Paper	60 +
Corrugated	252 +
Rubber	250
Glass (Cullet)	53,500
Ferrous Metals	3,064,700
Aluminum	80
Other Non-Ferrous	12,550 +

2. Sources of Materials - In addition to providing insight into the current use of various secondary materials, the survey of manufacturers also yielded information pertaining to the sources from which manufacturers obtain their secondary material requirements. Question 1c. of the survey asked the manufacturers to identify their present source(s) of secondary materials.

   a. Textile Industry - As indicated by one of the two respondents from the textile industry, the main source of materials presently used are charitable and civic organizations and also mixed rag graders.

   b. Paper and Allied Products Industry - The respondents from the paper and allied products industry indicated that they apparently obtain most of their materials from secondary materials dealers. Additionally, one respondent indicated that a portion of his material was obtained from direct mill contacts. "Company's Own Process" was also cited as a source of material.

   c. Rubber and Miscellaneous Plastic Products - The only respondent from this industry group indicated the source as being secondary material dealers.

   d. Stone, Clay and Glass Products - Of the two respondents which indicated that they presently use cullet (glass), both stated that they obtain materials from secondary materials dealers and their company's own process. Additionally, one of the respondents indicated that some material is obtained from charitable/civic organizations and also from resource recovery systems.

e. Primary Metals Industry - With respect to the primary metals industry, of those manufacturers who reported that they presently use some type of secondary material, 91 percent identified secondary material dealers as being a source of supply for both ferrous and non-ferrous materials. Additionally, 55 percent of the respondents indicated that their own manufacturing process constituted a source of supply. One respondent stated that he obtains aluminum and non-ferrous scrap from a smelter. None of these manufacturers reported any other sources of supply.

3. Future Material Utilization - Information regarding market potential for various additional quantities of secondary materials was sought from both manufacturers and secondary material dealers. Questions 2a. and 2b. of the survey of manufacturers were designed to obtain a measure of the level of interest on the part of manufacturers in obtaining additional quantities of secondary materials.

It should be stressed at this point that it was the aim of this inquiry to evaluate the market potential of secondary material in terms of the manufacturers' ability to absorb quantities of secondary materials, in addition to the amounts presently being absorbed or as a partial or total replacement of virgin raw materials. It was not the intent of this study to determine whether or not a new source of secondary material could displace present quantities being supplied to the market through more traditional sources.

Table 3-7 below summarizes, by major industry group, the number of positive responses to Questions 2a. and/or 2b.

TABLE 3-7

POTENTIAL SECONDARY MATERIAL UTILIZATION

INDUSTRY GROUP	"YES" RESPONSE TO QUESTIONS 2a. AND/OR 2b.	% OF TOTAL RESPONSES
22XX - Textiles	1	50%
26XX - Paper, et. al.	2	22
30XX - Rubber & Misc. Plastics	1	20
32XX - Stone, Clay, Glass	3	33
33XX - Primary Metals	6	43

Of the 40 companies responding to the survey, a total of 13, or 33 percent showed some interest in obtaining quantities of secondary materials to add to the present quantities they use and/or to partially replace some of the virgin material they presently use. It is also to be noted that all five major industry groups showed some level of interest.

With respect to the type materials for which interest was shown, examination of Exhibit 17 reveals that a wide range of material was indicated. Table 3-8 summarizes, by material type, the annual tonnages which the respondents estimated they might use.

TABLE 3-8

ESTIMATED FUTURE ADDITIONAL QUANTITIES OF SECONDARY MATERIALS

TYPE OF MATERIAL	TONS/YEAR
Clean Mixed Rags	Open
Secondary Fibers	30
Containerboard, Corrugated Medium	Unknown
Reclaimed Tires/Reprocessed Scrap Rubber	Open
Glass (Cullet)	227,000
Non-Ferrous Alloyed Ingots (Bronze)	300
Ferrous Scrap	
Urick Foundry Company	2,500,000
Other Respondents	27,500

Exhibit 19 presents the correspondence received to date from the secondary material dealers who responded to the letter of inquiry. Only two of these responses provided information regarding a possible willingness to accept quantities of secondary materials. The primary interest of these two respondents was for properly segregated ferrous and non-ferrous metal. One dealer also expressed some interest in glass, provided that it too was properly segregated. No interest was shown in obtaining any future quantities of tin-coated steel cans. Similarly, there was no expressed interest in textiles, rubber and plastic products, or paper products.

4. Market Constraints - The survey of manufacturers and the inquiries made to the various secondary material dealers yielded information pertaining to various constraining factors which bear upon the marketability of secondary material. Presented below is a discussion of a few of the market constraints mentioned by either manufacturers and/or secondary material dealers.

   a. Specifications - Exhibit 18 presents comments which were offered by manufacturers on their returned survey forms. A review of this material will reveal that the dominant constraint bearing upon the marketability of secondary material is the ability of the secondary material to meet specifications. Most manufacturers took care to emphasize that any secondary material presently used or which would be used in the future must conform to certain specifications which are dictated by either process or end product requirements. In general, most specifications dealt with size, shape, density, cleanliness, and the chemical composition of the secondary material.

Representing the textile industry (22XX), The Mundame Corporation did state that they presently use various forms of secondary material. However, they also indicated that they have had problems using any form of recycled material. Any contamination, such as by oil, grease, or paint was judged unacceptable.

Regarding the paper industry (26XX), no respondent cited specific specification constraints. However, one respondent indicated that waste paper and corrugated is of no value to them unless reconstituted at a paper mill. Another respondent indicated that usage of secondary material is dropping due to "too many quality problems."

With respect to the rubber & misc. plastics industry (30XX), no respondents expressed any desire in obtaining waste plastics. In general, due to the great variety of plastic products on the market and the nature of the manufacturing process itself, the investigations tend to show that markets for secondary plastic products are extremely limited. Regarding rubber, the Dunlop Tire & Rubber Company stressed the need for secondary materials to meet end product performance standards.

Respondents from the stone, clay, glass industry (32XX) also stressed specification requirements. For example, GTE Sylvania, Inc. requires that cullet must be free of foreign objects and contain only traces of organic or metallic matter. As another example, the Warren Concrete Products, Inc. declared that products they manufacture are governed by Federal, State and ASTM specifications and therefore it would be impossible to substitute raw materials.

Specification requirements were also stressed by the respondents from the Primary Metals industry (33XX). In general, those manufacturers stressed the level of "tramp" elements and size. Of special interest is the fact that Republic Steel Corporation requires that "Ferrous scrap in general should be as high as possible in iron content, and low in contaminants such as phosphorus, sulfur, tin, and other alloying elements." Simonds Steel indicated that they must operate under very close chemical specifications and therefore they buy only prime scrap from manufacturing operations. Similarly, Sharon Steel Corporation indicated a need for "carbon scrap only - no tin, no lead coating, no aluminum or non-ferrous attachments."

While the above comments tend to show severe restrictions upon the possible use of tin coated steel cans, it should be noted that the Consultant's investigations have revealed that certain major steel companies such as U.S. Steel and Bethlehem Steel are in the stage of developing tentative specifications for tin can material. The ultimate utility or value of this material, however, will rest upon the experience gained in use.

b. Economic - From the standpoint of the municipal solid waste recycling center, the basic economic constraint affecting the marketability of municipal solid waste is the price which either manufacturers or secondary material dealers are willing to pay for it.

While this preliminary study did not specifically address the subject of price, the research indicates that the general rule appears to be that the price which will be paid for a particular material (which meets specifications requirements) will be the going market price of that commodity, F.O.B. manufacturer's plant or dealers yard.

Table 3-9 below presents a tabulation of recent market prices for various secondary materials. Market prices were obtained from the February 9 edition of Iron Age magazine; the November 1975 issue of Wholesale Prices and Price Indexes published by the U.S. Department of Commerce, Bureau of Labor Statistics; and from comments offered by manufacturers, secondary material dealers, and recycling centers.

TABLE 3-9

SECONDARY MATERIAL MARKET PRICES

COMMODITY	MARKET PRICE	EFFECTIVE DATE
No. 1 Heavy Melting Steel (Pittsburgh)	$ 78.50/gross ton	February 9, 1976
No. 2 Bundles (Pittsburgh)	43.50/gross ton	November 1975
No. 1 Cupola Cast Iron (Chicago)	95.50/gross ton	November 1975
Aluminum-Old Sheets and Cast	218.40/gross ton	February 9, 1976
Clean, Heavy, Yellow Brass	571.20/gross ton	February 9, 1976
No. 1 Copper Wire	929.60/gross ton	February 9, 1976
Waste Paper		
No. 1 News	26.40/ton	November 1975
Old Corrugated	16.90/ton	November 1975
No. 1 Mixed	8.15/ton	November 1975
Reclaimed Rubber	288.00/ton	November 1975
Container Glass	20.00/ton	November 1975

It should be noted that the price which would be paid for baled steel cans would be the same as the going market price for No. 2 Bundles.

Exhibits 20 through 26 present recent trends in the market price for various types of secondary materials. Examination of these trends will show that at present the whole industry is depressed and, in fact, has been for the past year.

c. Geopolitical Constraints - A third constraint which must be considered when attempting to market various secondary materials is geopolitical in nature. In essence, the geopolitical constraint constitutes the situation in which a manufacturer will tend to utilize those secondary materials generated in his immediate locality, instead of receiving materials which are generated by more distant localities. This particular constraint would tend to become ever more important as larger numbers of recycling centers attempt to market increasing quantities of secondary materials upon a particular region's finite number of secondary material users.

SUMMARY OF FINDINGS

The major findings of this investigation are as follows:

1. If judged by the level of manufacturing activity within various key industries, it must be concluded that the region in and around Chautauqua County does possess market potential for various components of secondary materials.
2. Industry within the market region considered does currently use varying quantities of secondary materials in various manufacturing processes. With respect to material types, some textile waste, rubber, varying grades of waste paper, glass cullet, and ferrous and non-ferrous metals are all utilized.
3. Respondents to the inquiries took care to emphasize that secondary materials which are used must conform to a variety of processes or end product specification requirements.
4. The major source of secondary materials currently used by manufacturers is secondary material dealers. The second most often mentioned source is a company's own manufacturing process.
5. Both manufacturers and secondary material dealers did express some interest in obtaining additional quantities of secondary materials. The type of material most sought after was ferrous and non-ferrous metals. Respondents also expressed interest in obtaining various grades of waste paper and glass cullet. Minor interest was shown in obtaining textile waste and reclaimed rubber.
6. As with the secondary materials currently used, any additional quantities of materials would also have to conform to specifications. In general, the closer a particular commodity can conform to acceptable

specifications, the greater will be its marketability. Exhibit 18 of this Report provides some insight into the type of specifications to which secondary materials should comply.

7. The major metal component of municipal solid waste is tin-coated steel cans. This study uncovered little current use for this commodity with manufacturers, and in fact some manufacturers specifically cited tin-coated steel cans as being unacceptable. Most tin-coated steel cans which are marketed today are sold to the detinning industry. The total demand of this industry is severely limited however.

   Concerning the future, the consultant's research indicated that a number of major steel manufacturers appear to be making some effort to incorporate tin-coated steel cans in their furnace charges. Tentative specifications for this material have been developed. It must be remembered, however, that this material is the least preferable of all ferrous scrap used by this industry, and its ultimate market potential will depend upon operating experience.

8. Our research indicated that the price which would be paid for material meeting required specifications would be the going market price F.O.B. manufacturers' plant or dealers' yard. Based upon the comments offered by a number of secondary material dealers, it would appear that it would be extremely difficult to obtain long term contracts. The secondary materials industry is apparently too unstable and long term contracts are proving to be unworkable.

9. The present condition of the secondary material market is quite depressed and has been so for roughly the past year.

RECOMMENDATIONS

Based upon the results of this preliminary market investigation, the following recommendations are offered:

1. Exhibit 27 of this report lists the names of 14 manufacturers and three secondary material dealers who expressed some interest in obtaining future quantities of various types of non-virgin materials. As a more detailed estimate of achievable specifications, quantities, and timing becomes known, further contact with these companies is recommended. Specific points of contact for each of these companies are listed on Exhibit 28.

2. Based upon the nature of the responses to this study, it is especially recommended that further contact be made with the following companies:

   GTE Sylvania, Inc.
   Glass Containers Corporation
   Roblin Steel Company
   Republic Steel Company
   Dussault Foundry Corporation
   Simonds Steel
   Urick Foundry Company
   Sharon Steel Corporation

POTENTIAL ENERGY MARKETS FROM SOLID WASTES

INTRODUCTION

The potential energy available from solid wastes presents an important market incentive for resource recovery. Considered in this portion of the Chapter is a survey of the potential energy market for solid waste utilization in Chautauqua County. For this market survey it was considered that the utilization of energy from solid wastes would be either in the form of a solid refuse derived fuel supplement to existing coal fired boilers or a gasified refuse derived fuel supplement in conjunction with coal, gas or oil.

ENERGY MARKET APPROACH

To determine the facilities that could have boiler installations of sufficient size to accommodate potential supplemental refuse derived fuels, a boiler survey form was developed. Establishments with more than 200 employees in Chautauqua as well as industrial, chemical, paper and paperboard and plastic synthetics industries were forwarded a copy of the boiler survey form. Information supplied by this survey provided the initial "first cut" of unacceptable installations for utilization of a refuse derived fuel. Contained in Appendix D-1 is the letter sent to establishments requesting completion of the boiler survey form. Fifteen firms responded to the survey and the results are summarized in Table 3-10. Completed boiler survey forms by industries are included in Appendix D-2.

Parameters used to evaluate and identify potential users of a refuse derived fuel (RDF) from the boiler survey forms returned were:

1. Size and capacity of existing boilers, both hourly and 24 hour daily basis.
2. Fuel needs of the potential user.
3. Type of boiler(s) in use and fuel(s) for which it was designed.
4. Age of boiler(s).
5. Installed air pollution control equipment.
6. Proximity to or location with respect to Chautauqua County waste generation centers.
7. Receptiveness of user to utilize a refuse derived fuel.

The potential steam demand that could be generated from 385 tons of a 75 percent solid refined fuel fraction (RFF), i.e. 287 tons RFF @ 6,630 BTU per pound is approximately 102,500 pph (pounds per hour) on a 24-hour six day-per-week basis. Therefore, in the initial "pass" of boiler facilities

BOILER FIELD SURVEY
CHAUTAUQUA COUNTY, N.Y.

TABLE 3-10

Name & Location	Steam Capacity #/hr	Type of Boiler	Fuel	Start-up	Air Pollution Control Equip.	Avg. Summer Steam Load	Avg. Winter Steam Load
Peter Cooper Corporation Gowanda, N.Y.	10,350	Scotch Marine 3 Pass, Fire Tube	Gas or oil	1972	None	≈20,000 ppd	≈69,000 ppd
Witco Chemical Corporation Bradford, Pa.	50 M 2 @ 80 M ea.	WT WT	Coal/oil Oil	1-1937 2-1970	Mechanical Dust Collector	140,000 pph	170,000 pph
Allegheny Ludlum Steel Corporation Dunkirk, N.Y.	50,000 50,000	Water Tube Water Tube	Natural Gas Oil	1939 1942	None	19,000 pph	45,000 pph
Dresser Clark Olean, N.Y.	2 @ 60,000 ea. 1 @ 140,000 1 @ 52,000	All FM Standard	All #2 Fuel Oil & Natural Gas	1972 1974 1974	-	?	?
Asphalt Services, Inc. Jamestown, N.Y.	150	Gas Fired	Gas	?	-	60 pph (Summer Only)	
Kraft Foods Dunkirk, N.Y.	1 @ 30,000 2 @ 15,000 ea.	Water Tube	Gas	?	-	22,000 pph	26,000 pph
Carnation Company South Dayton, N.Y.	30,000	Water Tube	#6 Fuel Oil	1970	None	23,000 pph	23,000 pph
Kung Division of Ethan Allen, Inc. Mayville, N.Y.	1 @ 10,000 1 @ 20,000 1 @ 15,000	Water Tube	Wood Waste #6 Oil Wood Waste & #6 Oil	1940 1969 1955	None	9,000 0 8,000	10,000 20,000 15,000
Fred Kook Brewery Dunkirk, N.Y.	16,000 (2 @ 8,000)	Fire Tube Scotch Marine Boilers	Gas	1970 & 1971	-	-	-
*Niagara Mohawk Power Corporation Dunkirk, N.Y.	2 @ 680,000 ea. 2 @ 1,470,000 ea.	Natural Circulation Controlled Circulation Twin Furnace	Coal	1950 1959 & 1960	Electrostatic Precipitators	2 @ 515,000 pph 2 @ 1,010,000 pph	Same Same
Marlin Rockwell Division of TRW, Inc. Jamestown, N.Y.	2 @ 8,000 ea. 1 @ 20,000	Scotch Marine Water Tube	Coal	1970 1955	None	-	-
Renold Ajax, Inc. Westfield, N.Y.	15	ASME Standard	Natural Gas	-	None	-	-

in Chautauqua County, average hourly steam loads of at least 125,000 pph @ 24 hours were judged viable RDF users.

The following is a summary of respondents to the boiler survey and comments as to their suitability for RDF use:

1.	Peter Cooper Corp. Gowanda, NY	The average summer daily steam load is only a little over 20,000 lbs/day which is far below the potential quantity available. Additionally, the type of boilers available would necessitate furnishing a gas which, when combined with the distance from Chautauqua's waste generation centers, makes this an unattractive user.
2.	Witco Chemical Corp. Bradford, PA	The average summer steam load is 140,000 pph which would make this an attractive user from the standpoint of potential usage of total available refuse derived fuel. It is much too remote for consideration of furnished gas, therefore a prepared solid fuel would have to be made available. However, the distance to this potential market (in excess of 40 miles - one way - from Jamestown) led to the conclusion that overall it would not be worth pursuing unless no other markets could be identified in Chautauqua County.
3.	Allegheny Ludlum Steel Corp. Dunkirk, NY	The average summer steam load is 19,000 pph. The boilers are relatively old and are not currently equipped with air pollution equipment. Therefore, it was concluded to be a relatively unattractive user.
4.	Dresser Clark Olean, NY	Although the size of the boilers may be suitable, the package boilers available would necessitate furnishing a gas, which, when considering the distance from Chautauqua County, would make this economically unattractive.
5.	Asphalt Service, Inc. Jamestown, NY	Steam load much too small to consider furnishing refuse-derived energy - 60 pph for the summer only.
6.	Kraft Foods Dunkirk, NY	An average summer load of only 22,000 pph and winter load of 26,000 pph.

7.	Carnation Company South Dayton, NY	Average summer load of only 23,000 pph, 12 hrs. per day, and its distance from Chautauqua County, make this an unattractive market.
8.	Kling Division of Ethan Allen, Inc. Mayville, NY	Relatively low summer steam load of 17,000 pph combined with the fact that the plant is currently utilizing wood wastes for generating steam make this an unattractive user.
9.	Fred D. Koch Brewery Dunkirk, NY	Small capacity boilers, 2 @ 8,000 pph of steam and of the type that would require a gas, which make this an unattractive user.
10.	Niagara Mohawk Power Corp. Dunkirk, NY	Average total summer and winter load of 3,070,000 lbs/steam per hour. Two of the four boilers, each with a capacity of 670,000 lbs/steam per hour appear suitable for using a prepared refuse derived fuel. This is a very attractive market and the station superintendent is receptive. This plant is pulverized coal fired, having electrostatic precipitators and automatic ash handling equipment.
11.	Marlin Rockwell Division of TRW, Inc. Jamestown, NY	Type of boilers in operational status preclude the use of anything but a gas; however, the total average summer steam demand is quite low - 3,000 pph, making this an unattractive market.
12.	Renold Ajax, Inc. Westfield, NY	Very low boiler capacity - 15 pph precludes further consideration.
13.	True Temper Corp. Dunkirk, NY	No steam demand indicated.

Synopsis of Survey Results

As stated in the preceding comments upon each industry, it is apparent that, with the exception of Niagara Mohawk, the relatively low fuel demand and/or the location of the other potential users make them unattractive users of a refuse-derived fuel. The only other known potential user of a refuse-derived fuel which could utilize the total available potential energy from Chautauqua's solid wastes would be the Jamestown Board of Public Utilities Carlson Station (BPU). Thus, the "initial cut" of potential users illustrates that either Niagara Mohawk or the Jamestown BPU appear to be the most viable potential users in the County.

FIELD SURVEY

The boiler survey was followed by a field survey of potential solid refuse-derived fuel users and identified two additional possibilities: the Cummins Engine Company, Lakewood and the State University of New York - Fredonia Campus (SUNY).

The Cummins Engine Company indicated a positive interest in utilizing a refuse-derived fuel, and will be constructing a new boiler plant at some time in the future, date not determined. Cummins indicated a sincere interest in the prospect of utilizing a refuse derived fuel for the planned boiler facility. Since the boiler facility has not been selected to date, it would be easy to modify the new boiler for accepting a solid RDF. Although their current load is low (26,000 pph), it is anticipated to increase in the future to about 80,000 pph. This would accommodate at least the southern part of the County's wastes, if another fuel user were found for the northern section. As soon as Cummins Engine Company's planning for this boiler plant is firm, the County can then proceed to investigate this concept further. A letter of interest and boiler survey form from Cummins Engine Company is attached in Appendix D-3.

SUNY at Fredonia has gas fired boilers, which would preclude use of a solid prepared fuel. SUNY will be discussed in greater detail in the next section.

Table 3-10 shows the establishments visited during the field survey. A meeting was also held with the Chautauqua County Forester to determine if wood chips and bark or sawdust wastes generated in the County presented a disposal problem, and if they could be utilized in a resource recovery facility. Based on 1973 lumber production in the County, the following estimates were made:

Wood Chips - 731 tons per week; about one-half of this is currently available for disposal, the remainder is utilized by the paper industry. However, when economic conditions improve it is expected that there will be a 100% demand for wood chips by the paper industry. Therefore, in all likelihood, once the economic situation improves, there will be little or no wood chips requiring disposal.

Bark - 281 tons per week of bark are estimated to be generated in the County. However, current regulations are such that the bark waste is permitted to be disposed of on site. If the State were to enforce more stringent onsite disposal requirements this material could pose a future disposal problem.

Sawdust - An estimated 450 tons per week of sawdust is generated. However, about three-quarters of this is "contracted" as bedding material. Thus about one-quarter of the sawdust could pose a potential disposal problem.

It is concluded that bark and sawdust could be brought to the resource recovery facility. However, since this is not yet a serious disposal problem, significant quantities should not be expected.

VIABLE FUEL USERS SUMMARY

The fuel users which possess the best potential for accepting a refuse derived fuel are:

1. Niagara Mohawk - Dunkirk Station

2. Jamestown Board of Public Utilities Carlson Station

3. SUNY - Fredonia

4. Cummins Engine Company*

   *If future steam loads increase, and new boiler facility is compatible with a refuse derived fuel.

Appendix D-3 presents data on the boilers and loads for the four potential fuel users. The loads and facilities of these fuel users will be examined individually.

NIAGARA MOHAWK - DUNKIRK

The total steam capacity of the four boilers at the Dunkirk Station is 4,280,000 pph. Comparing the potential Chautauqua County steam potential from wastes (at 385 tons per day - 75% refined fuel fraction), 102,500 pph, the net impact would reduce their total steam load by about 2%, or one 670,000 pph boiler by 15%. Thus, there would be no steam load difficulty in accepting the total Chautauqua refuse derived fuel at Niagara Mohawk.

JAMESTOWN BPU - CARLSON STATION

The BPU has four boilers, 3 at 150,000 pph and one at 230,000 pph. Only boiler numbers 11 and 12, 150,000 and 230,000 pph respectively, are chosen for accepting either a solid or gaseous RDF.

Daily average power generated in Kilowatts per Hour (KWH) was determined for 1974 and 1975 by examining plant generated output records for the second week of each month during these years. The results are shown in Table 3-11 following.

The data from Table 3-11 is plotted on Figure 3-1 and 3-2. It appears that the minimum hourly KWH load generated for 1975 is about 21,000 KWH and the average hourly about 27,800 KWH. This yields, when converted to BTU, about 267,300,000 BTU for the average hourly minimum generated load and 350,000,000 BTU for the average hourly generated load. Comparing this to the daily BTU available in total potential refined fuel fraction for Chautauqua County's wastes (110,000,000 BTU per hour @ 24 hours) this yields, for the average hourly generated load, about 30% of the fuel

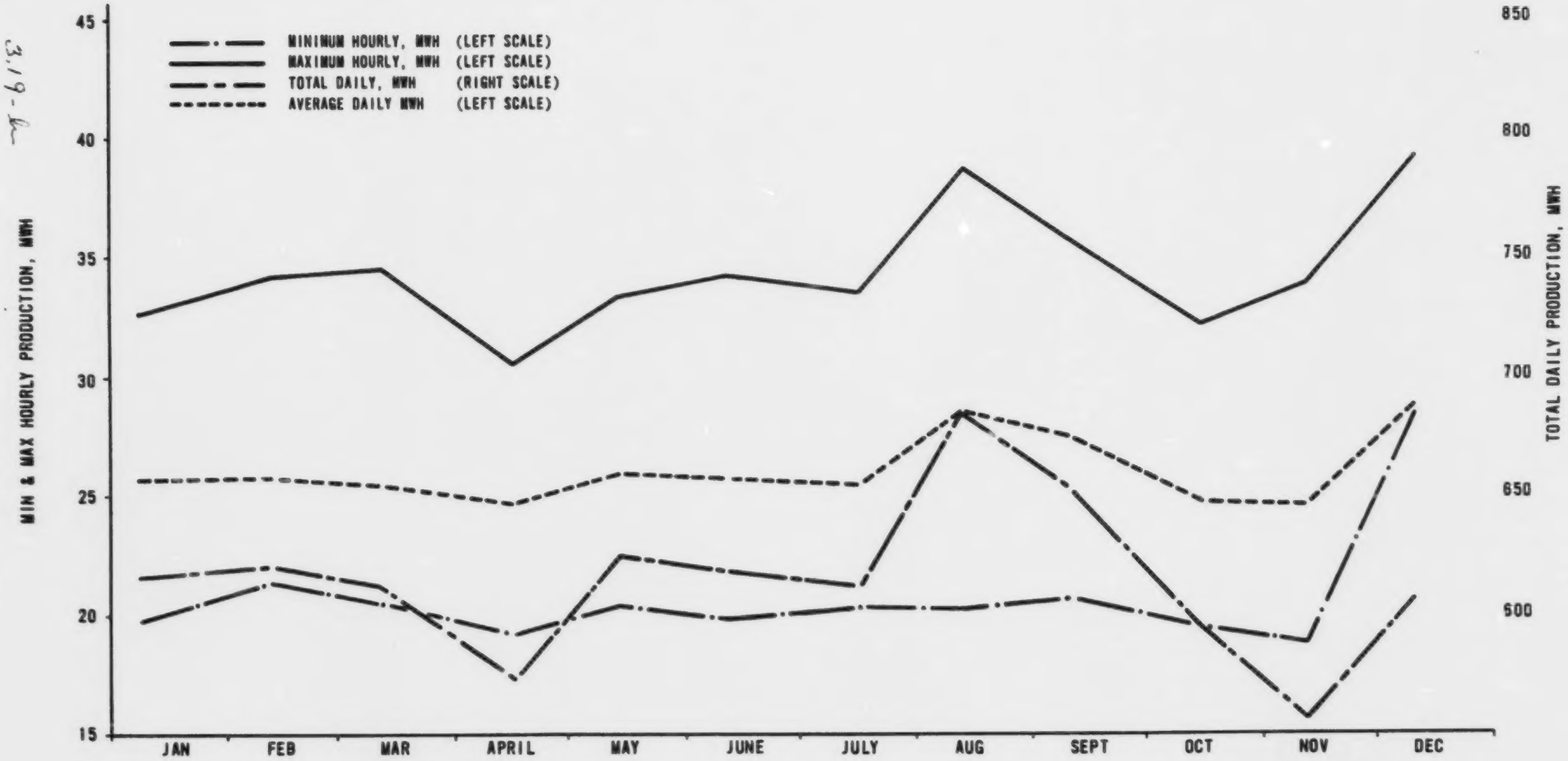
TABLE 3-11

JAMESTOWN BTU POWER PLANT DATA
POWER GENERATED DURING THE 2ND WEEK OF EACH MONTH

	Daily			
	MINIMUM HOURLY KWH	MAXIMUM HOURLY KWH	TOTAL KWH	AVERAGE* KWH
1974				
January	19,700	32,600	616,300	25,700
February	21,300	33,100	619,500	25,800
March	20,400	33,400	611,100	25,500
April	19,100	30,600	571,600	23,800
May	20,100	33,100	623,400	26,000
June	19,900	34,200	618,800	25,800
July	20,300	33,400	611,100	25,500
August	20,100	38,700	684,500	28,500
September	20,800	35,700	652,000	27,200
October	19,400	32,100	594,900	24,800
November	15,600	33,900	589,200	24,600
December	20,400	39,100	682,500	28,400
Daily Average	19,750	34,150	622,900	25,960
1975				
January	21,100	39,300	685,900	28,600
February	21,800	38,400	674,300	28,100
March	20,500	38,500	651,300	27,100
April	21,400	37,500	652,200	27,200
May	19,900	38,700	636,200	26,500
June	19,800	38,400	646,900	27,000
July	20,000	38,100	680,100	28,300
August	22,800	41,300	717,900	29,900
September	19,600	40,400	682,400	28,400
October	21,300	33,300	623,600	26,000
November	20,000	36,200	647,800	27,000
December	21,800	38,300	716,400	29,900
Daily Average	20,830	38,200	692,900	27,830

*Per 24 Hours.

ELECTRIC POWER GENERATED DURING THE 2ND WEEK OF EACH MONTH
JAMESTOWN BPU POWER PLANT DATA 1974
FIGURE 3-1



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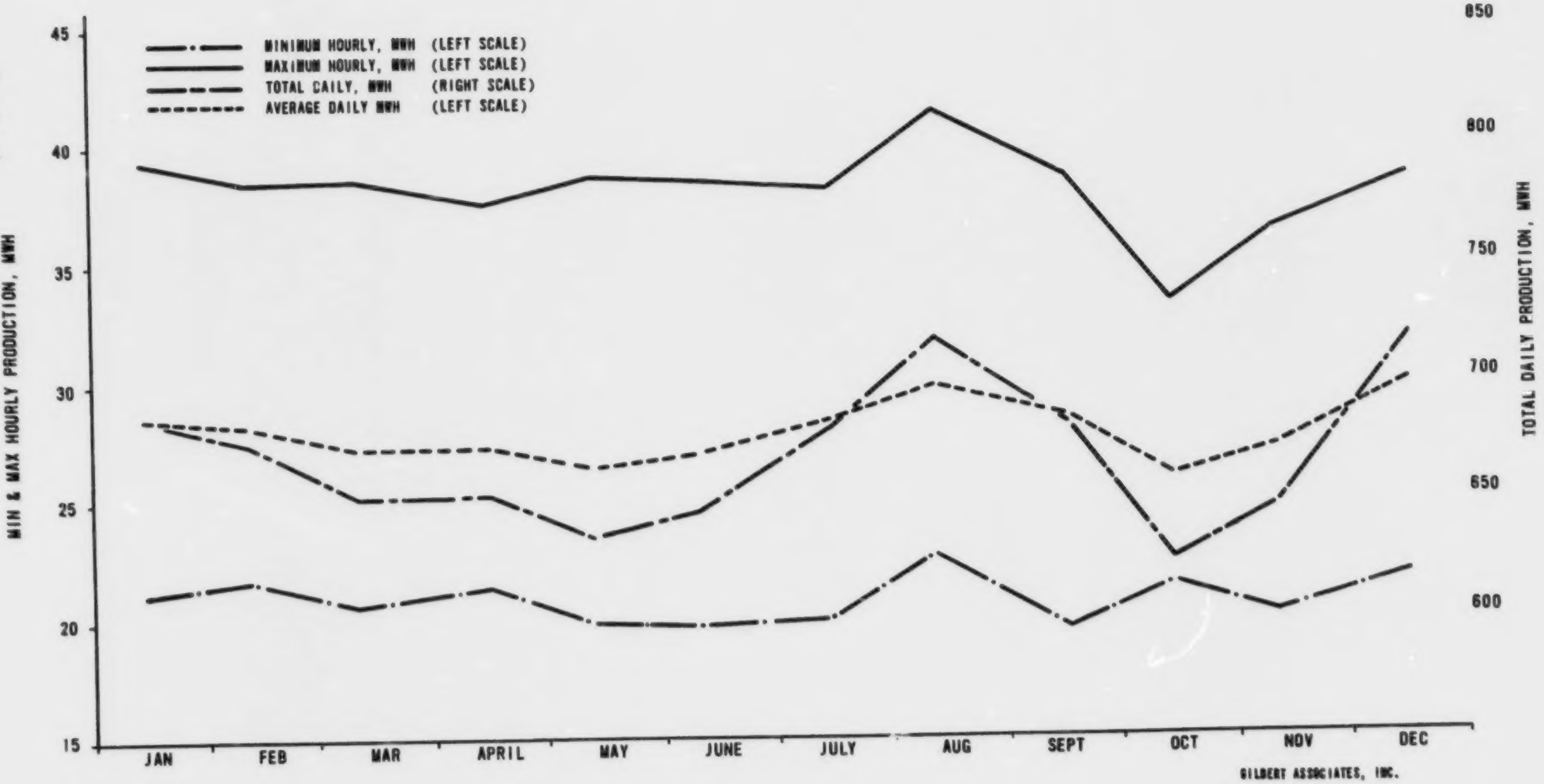
ELECTRIC POWER GENERATED DURING THE 2ND WEEK OF EACH MONTH
JAMESTOWN BPU POWER PLANT DATA 1975
FIGURE 3-2



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requirements supplied from a refuse derived fuel. At higher than average load demands, this would decrease and at lower than average load demands it would increase.

With respect to suitability as a fuel user, the BPU does offer a good potential, if the energy load supplement supplied from solid waste would be acceptable to the BPU.

A potential problem exists with the Jamestown BPU considered as a long term refuse-derived fuel user. The problem stems from its combination of purchased power and generating power. Data from the 1974 and 1975 BPU annual reports indicate that it has cost the BPU much more to generate its own power than to purchase power from the New York State Power Authority.

Currently, the BPU is limited as to the amount of power it can receive from the Power Authority due to transmission line capacity limitations. If the current trend of generating power more expensively than it can be purchased continues, the long term outlook for continued power generation at the BPU Carlson facility does not look favorable.

A summary of pertinent Jamestown BPU Carlson Station operating costs is given in Appendix D-4, extracted from the 1975 Jamestown Board of Public Utilities Annual Report. Also included is an analysis of the impact of the BPU utilizing the RDF under the best of economic conditions - receiving it from the County at no cost, and comparing the economic benefit to the existing station costs and potential power purchase costs.

Summarizing the data presented in Appendix D-4, it costs the BPU approximately 2.8 times more to generate power than to purchase power from Power Authority of the State of New York (PASNY) in 1975. One major reason for this cost condition is BPU's coal expense, about $28.00 per ton. Of the BPU annual generating costs, coal accounted for about 75%. If it were possible to purchase all the power required at the Jamestown BPU from PASNY at the 1975 cost, the potential net savings would be equivalent to about 90% of the 1975 coal costs. If a solid RDF is considered for use at the BPU facility, it would displace approximately 35,250 tons of coal annually, or 125 tons daily over 282 operating days. Assuming that the displaced coal was credited at the 1975 cost of $28.28 per ton against the 1975 gross operating cost (since it was assumed that the RDF is given to the BPU at no cost), the use of the RDF would reduce the total annual BPU power operating costs by about 20%. However, if BPU should pay for the RDF at a rate of 75% of current coal costs, the use of RDF then would reduce the total annual BPU operating costs for generating electric power by approximately 5%. If the cost savings of purchasing all power, if possible, are compared with the 1975 total cost, it is 56% less expensive to purchase all power, than continue the current practice of purchasing and generating power.

By comparing the cost savings of the 1975 total costs and including the RDF supplement credit (in coal displacement value) as previously discussed, versus the cost to purchase all power, if possible, it would still be 46% less expensive to purchase all power than to generate, purchase and utilize solid RDF provided to the BPU from the County at no cost.

Summarizing the Jamestown BPU findings:

1. It appears that the cost of generating power will be more expensive than purchasing power even assuming free solid RDF.

2. With the current restriction on the BPU on the amount of purchasable power from PASNY due to transmission line capacity, it appears for the near future that the BPU has no alternative but to continue to generate its own power.

3. Unless the cost of purchased power increases or the cost of coal decreases to a level that makes the BPU power generation cost more competitive with PASNY costs, the BPU could increase transmission line capacity so that it could purchase all its power, and stop generating altogether. This would probably take several years to materialize until all parties, Jamestown BPU, Niagara-Mohawk Company, and PASNY could come to an agreement.

4. An estimated 20% plant operating cost reduction could be obtained at the BPU Carlson Station under present operating conditions, by utilizing solid-RDF, at no charge to the BPU.

5. An estimated 5% plant operating cost reduction could be obtained at the BPU Carlson Station under present operating conditions, by utilizing Solid-RDF at a 75% charge of existing coal costs for the solid-RDF.

In the light of the previous discussion, the BPU as a potential long term fuel user seems at best questionable. It may be the posture of the BPU to continue to generate power, either through their own desire to do so, or by the limitations on purchasing additional power from PASNY. One limitation is currently restricting additional purchasing of power - the transmission line capacity restriction. Other limitations may be the lack of additional available power for sale to the BPU from PASNY, above the amount currently received or the desire by PASNY that the BPU continue to generate power, regardless of the cost differential in purchased power. Only the Jamestown BPU can provide the answer to the question as to whether they will be generating power for next 10 to 20 years.

The position taken in this report with regard to the Jamestown BPU situation is that they are considered as a potential RDF user. Should the County select an alternative for implementation that involves the Jamestown BPU as the user of the refuse derived fuel product, the County should enter into discussions with the BPU to determine the continuance of power generation at the BPU plant.

Certain questions were expressed by the Jamestown BPU about the use of a Solid-RDF in their boiler system. These questions were submitted to the manufacturer of boiler nos. 11 and 12.

Included in Appendix D-5 is the list of questions of the Jamestown BPU and the response given by the boiler manufacturer. Also included in

Appendix D-6 is an excerpt from "Fuels from Municipal Refuse for Utilities: Technology Assessment," by the Electrical Power Research Institute, March 1975. Contained therein are data collected and summarized of the effects of using solid and gaseous refuse derived fuels on utility boilers. This discussion is included in this report to supplement the information supplied by the Erie City Energy Division of Zurn Industries.

SUNY - FREDONIA

There are three boilers at the SUNY power plant, rated at 25,000,000, 65,000,000, and 100,000,000 BTU/hr. They are high pressure, high temperature boilers. Examining the fuel records, these boilers could accommodate either oil or gas. Therefore, a gaseous RDF would be required for use. Load demands are as shown in Table 3-12 and Figure 3-3.

Records of the load demands for the SUNY boilers were examined for the one-year period from May 1974 to April 1975. The energy load/demand periods are divided into three average periods - summer, fall and winter load periods. From examination of this data the average daily load demands for the three load periods beginning with the summer period are determined to be 510 MBTU*, 720 MBTU and 1020 MBTU respectively, with the average daily load demand for the year at 775 MBTU. If all of Chautauqua County daily processable wastes are converted to a gas, this yield would be about 1830 MBTU (discussed in more detail in Chapters 5 and 7). This provides a significantly higher fuel supplement than load demand. If the County's waste load is divided into two parts, each going to different fuel users, then the load at SUNY may more closely align with the energy available from the wastes. Since SUNY-Fredonia is in the northern section of the County, they could be considered a potential fuel user for northern county wastes while the Jamestown BPU or the Cummings Engine Company are potential fuel users for the southern county wastes. These alternatives will be examined in Chapter 7.

CUMMINS ENGINE COMPANY

As mentioned earlier, the Cummins Engine Company potential future steam load is estimated at 80,000 pph over 24 hours. Since this load would not be sufficient to handle the entire county solid fuel supplement potential, the Company should be considered for southern county wastes and SUNY-Fredonia for the northern county wastes. As previously discussed, the current Cummins load is only 26,000 pph, but they are planning to install a new boiler plant with estimated load at 80,000 pph.

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*MBTU - Million BTU

TABLE 3-12

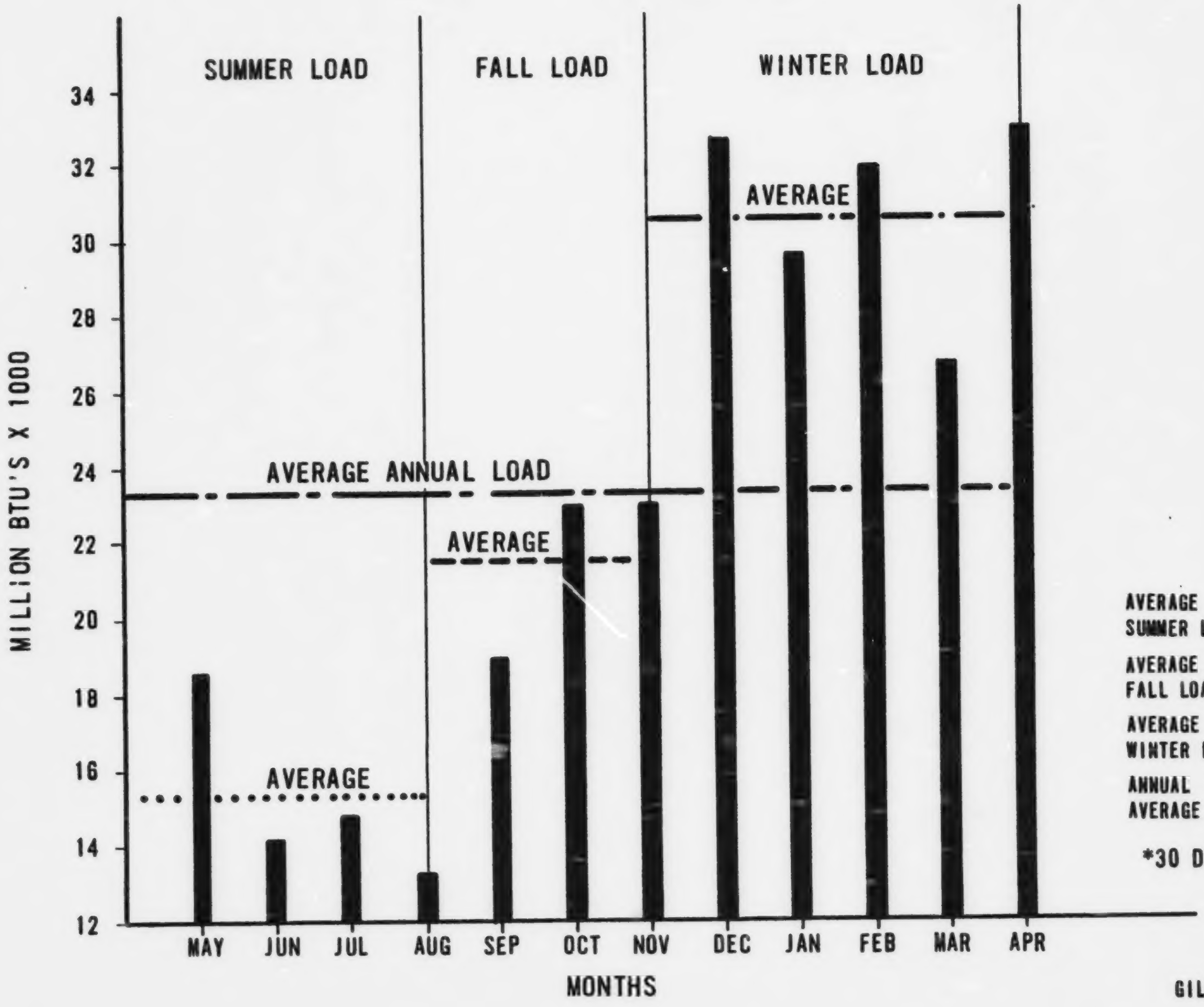
SUNY FREDONIA, NEW YORK
MAY, 1974 - APRIL, 1975

ENERGY LOAD DEMAND

Months	Natural Gas (1) M Btu(4) x 1000	Fuel Oil(2) M Btu x 1000	Total M Btu x 1000		Seasonal (3) Average Btu Demand Monthly (M Btu)	Seasonal (3) Average Btu Demand Daily (M Btu)
May	18,610	0	18,610	S	15,230	510
June	14,105	0	14,105	S		
July	14,866	0	14,866	S		
August	13,320	0	13,320	S		
September	18,946	0	18,946	F	21,610	720
October	22,931	0	22,931	F		
November	22,958	0	22,958	F		
December	32,680	0	32,680	W	30,750	1,020
January	29,578	0	29,578	W		
February	31,927	0	31,927	W		
March	26,622	0	26,622	W		
April	32,960	0	32,960	W		
		Total Annual Btu Load Average:			23,300	775

(1) 1000 Btu/1 cubic foot natural gas
(2) 145,000 Btu/gallon fuel oil
(3) S: spring, F: fall, W: winter
(4) M Btu; million Btu

TOTAL MONTHLY BTU'S UTILIZED
SUNY - FREDONIA
MAY, 1974 THROUGH APRIL, 1975
FIGURE 3-3



	DAILY* (MILLION BTU'S)
AVERAGE SUMMER LOAD:	510
AVERAGE FALL LOAD:	720
AVERAGE WINTER LOAD:	1020
ANNUAL AVERAGE LOAD:	775

*30 DAYS PER MONTH

GILBERT ASSOCIATES, INC.
READING, PA.

CHAPTER 4

APPLICABLE ENERGY RESOURCE RECOVERY SYSTEMS

INTRODUCTION

The basic practical concepts for recovering the energy values in mixed municipal refuse (MMR) can be related to the form in which the refuse is utilized as a fuel. When beneficiated to some degree, it has been termed refuse derived fuel (RDF). The basic current forms may be classified as:

A. As-discarded MMR

B. Shredded MMR

- o not classified
- o beneficiated[(a)] shredded MMR with some degree of metallics and ceramics separation (classification)
- o beneficiated shredded MMR classified and densified

  -cylindrical pellets approximately: 3/8" dia. by 1" long
  : 1" dia. by 2" long

  -cubettes approximately: 1-1/2" x 1-1/2" x 2"
- o beneficiated shredded MMR classified and powdered to pass 100% through 100 mesh screening
- o beneficiated shredded MMR classified and gasified

  -oxygen deficient thermal pyrolysis
  -anaerobic digestion natural or mechanical induced

C. Beneficiated MMR by wet-pulping and classification

-pressed pulp
-dried and densified into pellets

SYSTEMS METHODOLOGY

The basic waste thermal energy recovery options are shown diagrammatically on Figure 4-1.

The as-discarded form of MMR (A) thermally processed with heat recovery is exemplified by many installations in Europe, and in Harrisburg, Chicago, Nashville, Braintree, Norfolk, and Montreal, which are incinerators having waterwalls followed by a convection bank, economizer and air pollution control equipment. There are a number of older installations which utilize a refractory furnace for combustion, with a convection boiler bank for

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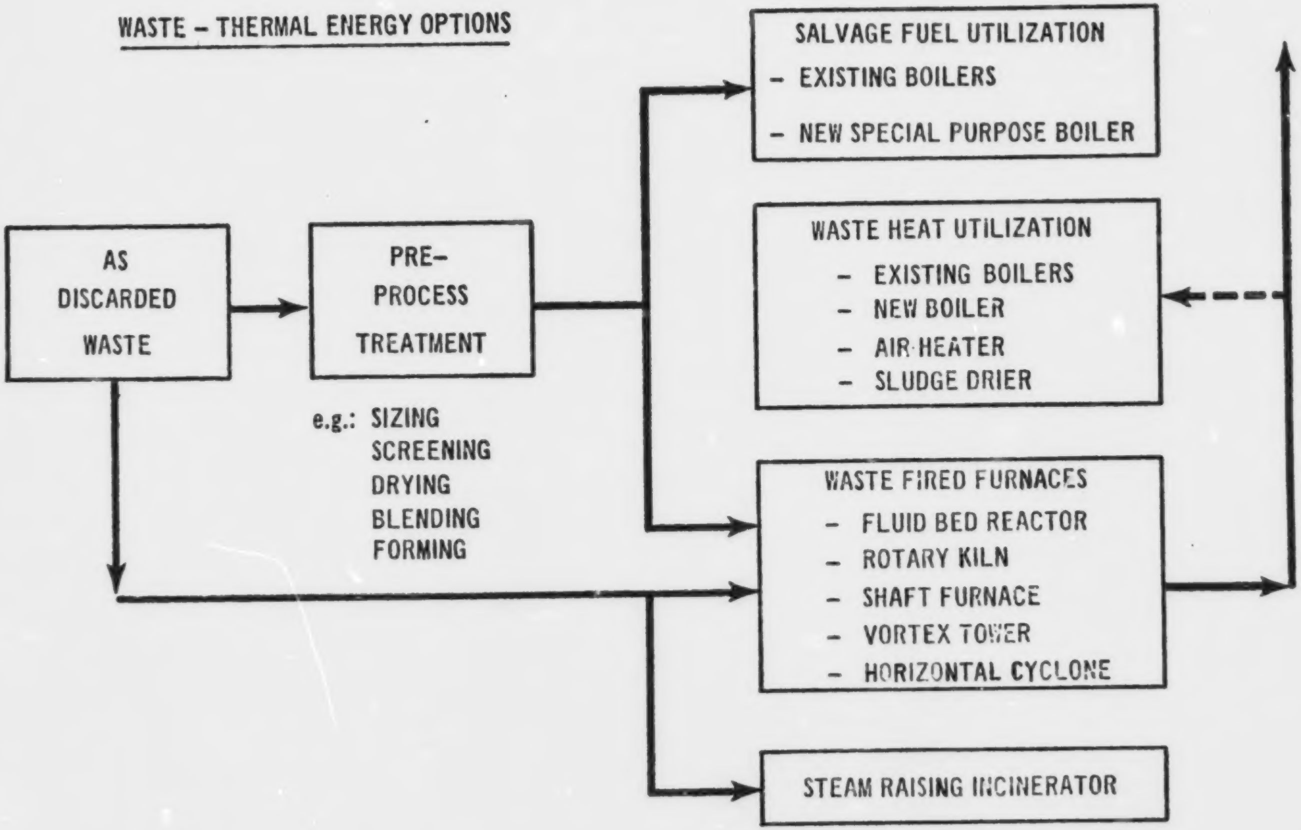
(a) beneficiated - to perfect by increasing desirable qualities.



WASTE – THERMAL ENERGY OPTIONS

AS DISCARDED WASTE
PRE-PROCESS TREATMENT
e.g.: SIZING
SCREENING
DRYING
BLENDING
FORMING
SALVAGE FUEL UTILIZATION
– EXISTING BOILERS
– NEW SPECIAL PURPOSE BOILER
WASTE HEAT UTILIZATION
– EXISTING BOILERS
– NEW BOILER
– AIR HEATER
– SLUDGE DRIER
WASTE FIRED FURNACES
– FLUID BED REACTOR
– ROTARY KILN
– SHAFT FURNACE
– VORTEX TOWER
– HORIZONTAL CYCLONE
STEAM RAISING INCINERATOR

FIGURE 4-1

recovering waste heat from the hot flue gases, exemplified by the installations at Merrick and Oceanside, L.I., New York, among others.

These installations were all conceived to generate most of their on-site energy needs, with surplus steam generation being condensed for system return when off-site use was not needed. Export of steam requires the steam user to be in close proximity to the refuse-fired steam generating plant. Heat extraction through steam generation permits plant installations incorporating modern efficient air pollution control (APC) equipment of much reduced size, since air flow (and therefore gas flow) is less than one-third of that required for conventional incinerators, and flue gas temperatures exiting from heat recovery systems are within the tolerances of conventional construction materials for APC equipment.

Most steam-raising incinerators in the U.S. generate steam at modest pressure with little or no superheat. The newly-completed facility at Saugus, Massachusetts will be supplying steam to the nearby General Electric Plant at 690 psig(a), 875° FTT(b) with 350° FFW(c). This energy level is higher than for any of the previous refuse fired steam plants in the U.S. and Canada. The Saugus plant is equipped with two 600 TPD furnace-generator systems. The smallest refuse-fired steam generating plant is at Braintree, Massachusetts. This plant is equipped with two 125 TPD waterwall furnace-boiler systems operating at 175 psig, with no superheat. The systems at Saugus and Braintree are each equipped with electrostatic precipitators.

A sectional elevational general arrangement of the new Nashville plant is shown on Figure 4-2 and a similar illustration of the Braintree plant is shown on Figure 4-3.

New steam-raising incinerator plants are usually equipped with at least two furnace-steam generating systems thereby permitting a realistic regimen for preventive maintenance, time for system inspection and turn-around, and to reasonably assure on-going service for waste processing and steam production.

Although there are many installations using this concept, domestic and foreign, it was not seriously considered for Chautauqua County for the following basic reasons:

> This concept was not consistent with the intent or provisions of the New York State Resource Recovery Act.
>
> A feasible facility equipped with two 200 TPD furnaces would have to be located in close proximity to a steam user who could readily accommodate up to 125,000 pounds steam per hour at modest pressure

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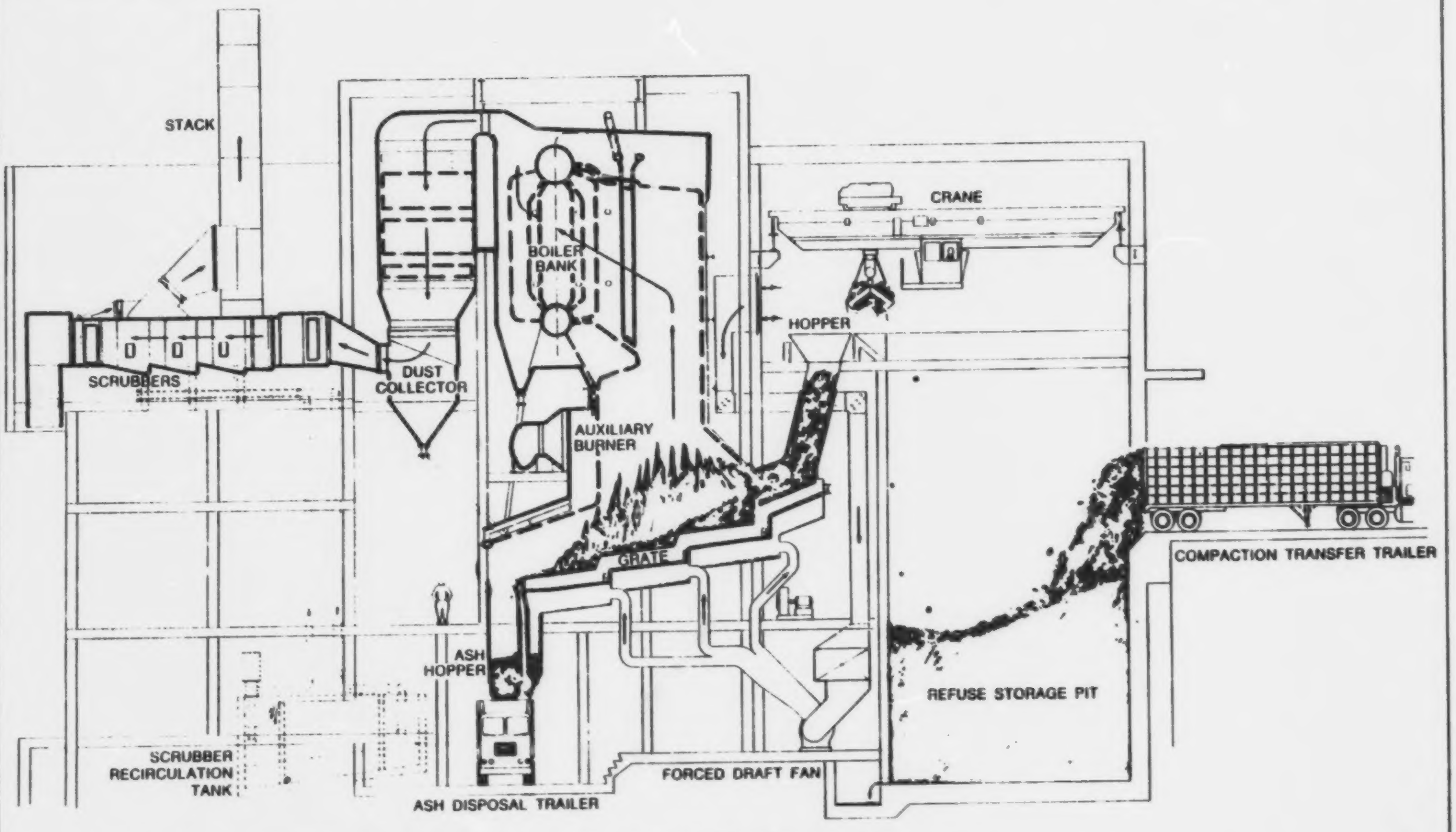
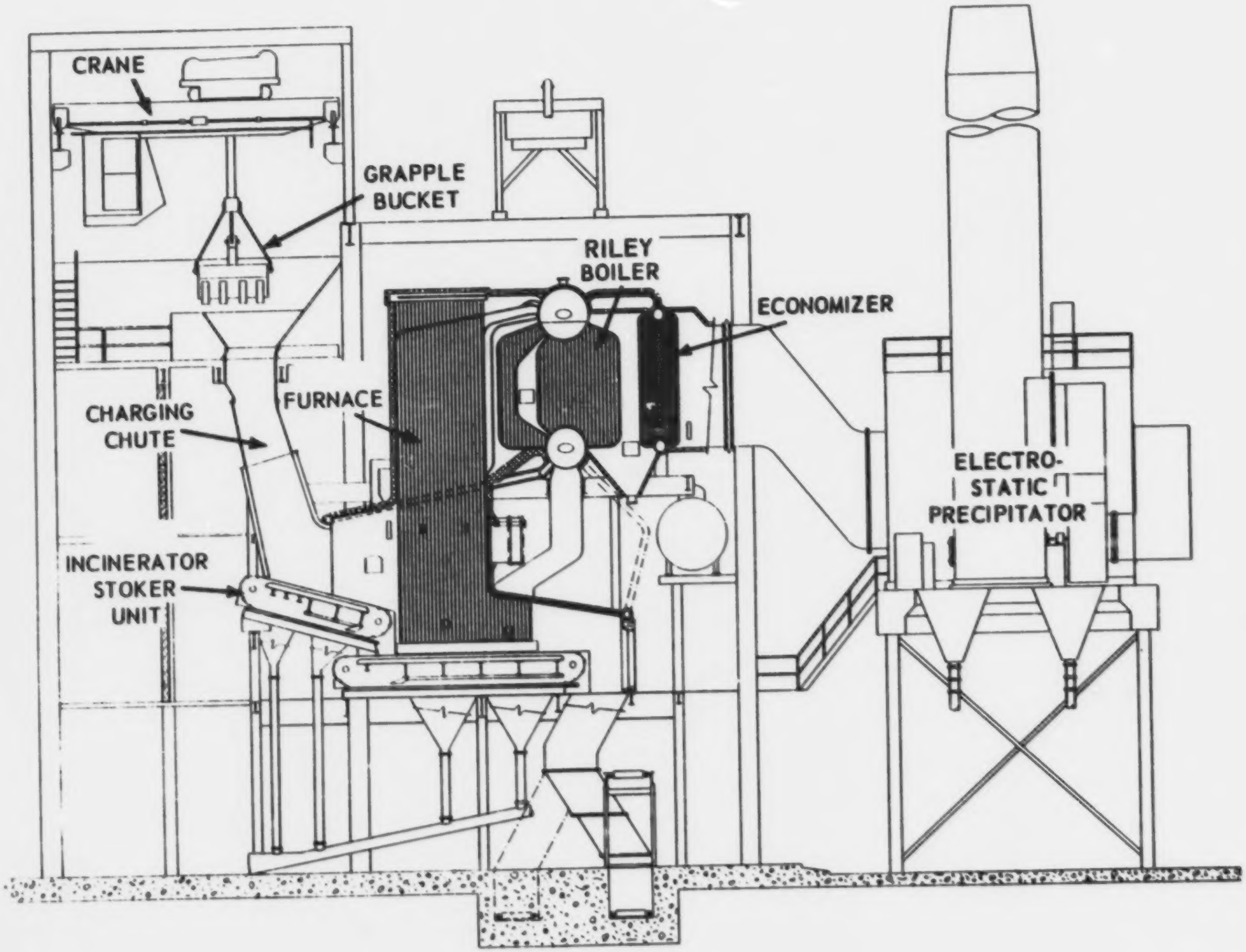
(a) psig - pounds per square inch, gauge
(b) FTT - operating steam total temperature, degrees Fahrenheit
(c) FFW - feedwater temperature, degrees Fahrenheit


STACK
CRANE
BOILER BANK
HOPPER
SCRUBBERS
DUST COLLECTOR
AUXILIARY BURNER
GRATE
COMPACTION TRANSFER TRAILER
ASH HOPPER
REFUSE STORAGE PIT
SCRUBBER RECIRCULATION TANK
FORCED DRAFT FAN
ASH DISPOSAL TRAILER

NASHVILLE, TENNESSEE THERMAL WASTE CONVERSION PLANT

FIGURE 4-2


CRANE
GRAPPLE BUCKET
RILEY BOILER
ECONOMIZER
FURNACE
CHARGING CHUTE
INCINERATOR STOKER UNIT
ELECTRO-STATIC PRECIPITATOR

BRAINTREE MUNICIPAL THERMAL WASTE CONVERSION STATION
BRAINTREE, MASSACHUSETTS
FIGURE 4-3

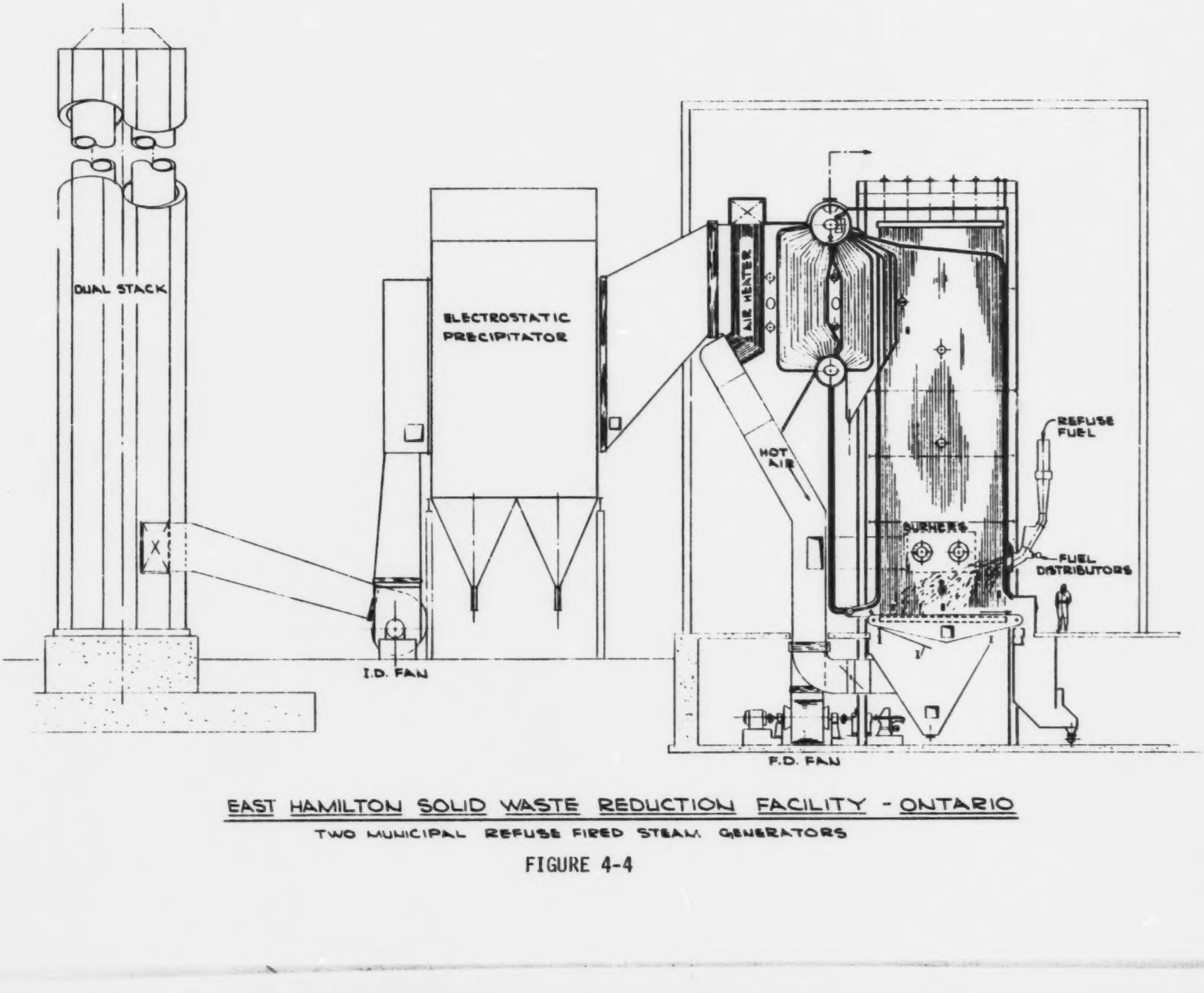
and temperature. The only steam user who could absorb this steam flow is the Jamestown BPU Carlson Station, and the steam conditions are 900 psig, 900° FTT which is at an energy level significantly higher than even the Saugus facility. The only recourse would be to generate steam-electric power at the refuse-processing plant and transmit surplus power to the Jamestown BPU system.

Shredded MMR provides many options for utilizing the "energy resource" values in refuse and enhances the potential for recovering the "material resource" values. All thermal reduction systems provide superior performance and system control coincident with the physical and thermo-chemical uniformity of the material to be consumed. Even systems designed to burn as-discarded materials in mass would benefit from coarse size reduction and material homogenization which would result from the crude process.

The extent of beneficiation should only be to satisfy the basic needs of the user. Additional refinement is not necessarily performance or cost-effective, unnecessarily complicates the system, can require additional equipment, structure, power, or personnel and introduces additional areas of vulnerability to outage.

The system shown schematically in Figure 5-2 was selected to provide a shredded fuel fraction refined to suit boilers similar to the Jamestown BPU steam generators #11 and #12 or the Niagara Mohawk-Dunkirk Boilers. The refined fuel fraction would be sized to pass 100% through 1" square screening with a practical minimum of entrained metallics and ceramics.

There are several plants in operation or under construction which will process and/or consume shredded RDF. The extent of fuel refinement differs from plant to plant. The Hamilton Ontario installation has provision for only magnetic separation of ferrous material from the shredded refuse. This plant is equipped with two 300 TPD furnace systems arranged to burn 100% RDF in conventional Two-Drum Single Pass boilers having welded membrane furnace wall construction. Each steam generating unit has a tubular air heater and electrostatic precipitator and is designed to generate 100,000 pounds steam per hour without auxiliary fossil fuel, at 250 psig, saturated. A partial side sectional general arrangement sketch of the Hamilton steam generating systems is shown on Figure 4-4. A similar facility is under construction for the City of Akron, Ohio. Steam produced will be the only source of supply to the central city steam distribution system. The largest industrial process and heating steam customer will be the B. F. Goodrich Plant. The City of Ames, Iowa has adapted three of the boilers in its Municipal Light Plant to accommodate beneficiated shredded RDF as supplementary fuel. The City of Chicago will be supplying the Commonwealth Edison - Crawford Station with beneficiated shredded RDF. The City of Milwaukee now has under construction a facility to provide Wisconsin Electric with beneficiated shredded RDF. There are other similar situations in various stages of development or implementation including the Union Colliery - Union Electric project which will receive and process 8000 TPD of MMR at the Meramec and Labadie Union Electric generating stations.


DUAL STACK
I.D. FAN
ELECTROSTATIC PRECIPITATOR
AIR HEATER
HOT AIR
BURNERS
REFUSE FUEL
FUEL DISTRIBUTORS
F.D. FAN

EAST HAMILTON SOLID WASTE REDUCTION FACILITY - ONTARIO

TWO MUNICIPAL REFUSE FIRED STEAM GENERATORS

FIGURE 4-4

Densification of shredded and classified refuse provides an attractive form of RDF for stoker-fired boiler designs. The RDF can be formed into pellets or cubettes which have a specific weight ranging from 25 to 35 pounds per cubic foot as compared to coal of 50 to 55 lbs/cu.ft. and unformed shredded waste (which has been classified) of 6-8 lbs/cu.ft. The shredded RDF in densified form is more readily handled, bunkered and retrieved. It has reasonable structural integrity and handles similar to a granular material. Obviously it must be protected from weather. No industrial size stoker-fired boiler installations were encountered in the facility survey conducted during the course of this study. (Refer to Chapter 3). Some preliminary trials have been conducted at a utility plant in Pennsylvania, introducing formed RDF pellets with coal into a ball tube pulverizer. The short run pulverizing and burning trials were encouraging.

Refining shredded waste chemo-mechanically into a fine powder also has much appeal. The shredded-classified fuel fraction is powdered in a large ball tube pulverizer using preheated balls and a chemical additive to accelerate breaking down of the cellulosic fibers and binders. The less-than-100 mesh screened powder, having 65% volatile matter, could be burned separately or in combination with pulverized coal. The developers also claim it can be suspended in fuel oil and the composite consumed with conventional heavy duty oil burners. In view of the fine particle size of the fuel and its high volatile matter, special provisions may be required in handling and storage to avoid fire and personnel hazards. These concerns may be alleviated if the powdered RDF is formed into briquettes which could be readily reduced back to powder in the boiler pulverizers.

This proprietary powdered RDF process is still in development. The first commercial scale fuel processing installation should be in operation by Summer 1976. The developer feels that a processing facility would become economically attractive for waste quantities greater than 600 tons per day.

The gasification of MMR by pyrolysis (thermal reduction in an oxygen-deficient atmosphere) is enhanced, with superior system control, if the wastes are subjected to basic size reduction. This will not only provide a more physically uniform material for processing but will also permit removal of much of the ferrous metal and even some ceramics (glass), which may have some material value, but are energy absorbers contributing little if anything to the production of useful fuel gas. These constituents can be deleterious to the construction materials of the furnace and can be burdensome in maintaining a flowing smelt from a system designed for continuous slag tap. The two waste-gasification system which have had extensive prototype operation are the Purox oxygen-blown slag tap system and the Torrax air-blown slag tap system. Although there are no commercial installations of these systems in operation or under construction in the U.S., there is a Torrax installation under construction in Europe. The Landgard kiln pyrolysis system is only available in capacities for 1000 TPD and for this reason, among others, it was considered inappropriate for consideration in Chautauqua County. The flash pyrolysis system of Garret-Occidental, the Plasma Torch Converter system of Resource Recovery Corporation, the URDC - United Hamilton Standard system and the Tech-Air system by American Can, as well as several other emerging systems, were considered too complex and/or too developmental to warrant significant consideration at this time.

The Purox waste gasification system being developed by Union Carbide, (schematically illustrated in Figure 4-5) incorporates a vertical shaft furnace (cupola concept) approximately 12 feet in diameter by 40 feet high. Mixed municipal refuse would be coarsely shredded to six inch top size, followed by basic classification with the fuel fraction charged into the top side of the reactor through two 14 inch cylindrical rams. This charging system design is intended to also act as a plug seal to the reactor. This is necessary to avoid air infiltration which would dilute the CO-rich fuel gas, and possibly induce premature combustion or permit the produced fuel gas to escape.

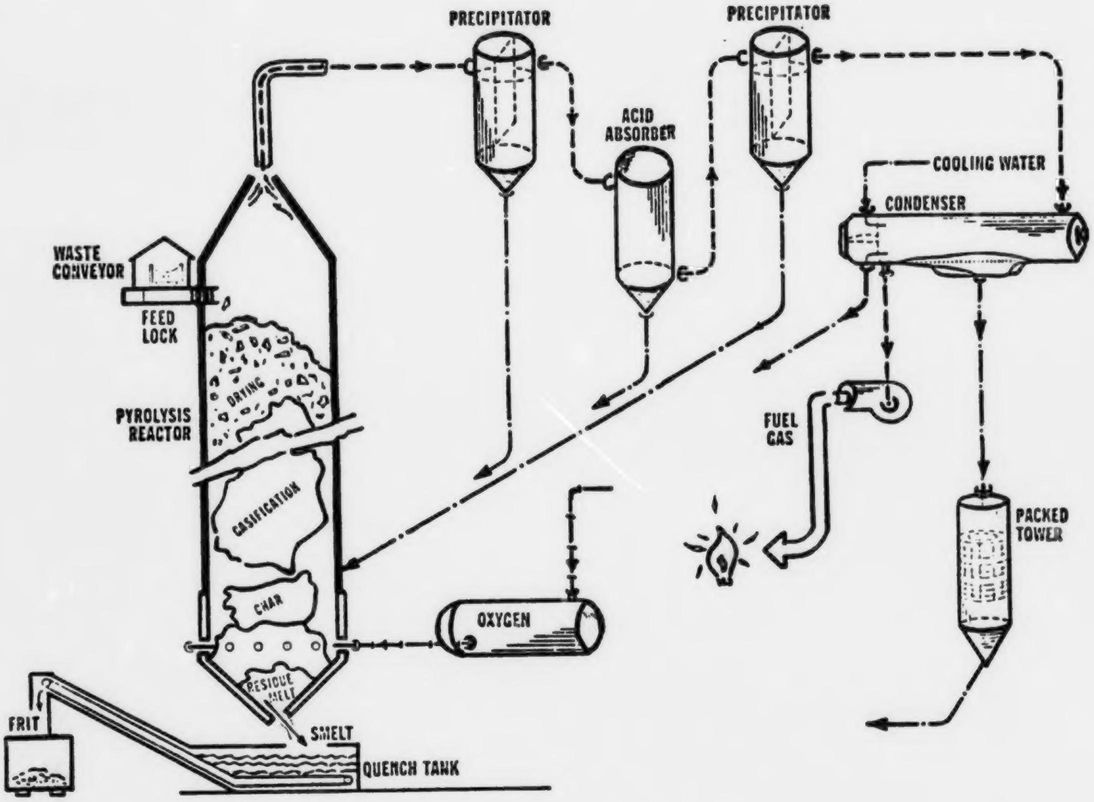
Gaseous Oxygen of industrial quality would be supplied by an on-site cryogenic air separation system. The oxygen gas would be blown through tuyeres(a) into the hearth section at the bottom of the reactor. The resulting intense combustion of the char remaining from the gasification of the hydrocarbons provides the high thermal flux to maintain the 2900° F to 3100° F temperatures necessary to sustain the pool of smelted inorganics which have gravitated to the reactor bottom. The only external heat input would be a small gas or oil flame directed at the slag tap hole and drain spout to avoid possible solidification of the smelt during tapping. Ordinarily, the smelt is tapped continuously, discharging into a water quench tank where it is chilled and shattered into a dense inert granular "frit."

The hot gases from the hearth zone rise through the descending column of waste in the reactor, pyrolyzing organic materials into gases, liquids and char. The char and some tars pass down into hearth area as do the inorganic constituents. The hot gases rising through the reactor dry and preheat the waste bed as it gravitates down thru the devolitization-gasification zone.

Gases leave the top of the reactor tower at 350°F to 450°F and 2 to 5 inches w.g.(b) and are washed by a water spray enroute to a "tar" type electrostatic precipitator where oil and particulates are removed and reintroduced directly into the reactor hearth. The gases would then pass through an acid scrubber-absorber to remove HCl, H_2S and any volatile organic acids. The salts may be bled from the scrubber liquor and introduced into the hearth to be disposed of with the molten slag. The gases then pass through a condenser to remove water from the saturated vapor and then are compressed to 35 psig or whatever is required for delivery to the fuel user's system.

(a) Air emitting ports into a furnace.

(b) Water gauge; pressure.


PRECIPITATOR
PRECIPITATOR
ACID ABSORBER
COOLING WATER
CONDENSER
WASTE CONVEYOR
FEED LOCK
DRYING
PYROLYSIS REACTOR
GASIFICATION
CHAR
FUEL GAS
PACKED TOWER
OXYGEN
RESIDUE MELT
FRIT
SMELT
QUENCH TANK

WASTE/FUEL GASIFICATION
FIGURE 4-5

All indications are that the product fuel gas is commercially clean and would have the following analysis as derived from typical mixed municipal waste.

Major Constituent	Volume - %
H_2	26
CO	40
CO_2	23
CH_4	5
C_2H_6	5
N_2 & A	1
HHV	350 Btu/SCF @ 80°F
Gross Energy in MMR	9.5 mB/ton MMR
Gross Energy in RDF Gas	7.5 mB/ton MMR
Net Energy Available in Gas	6.5 mB/ton MMR

A material flow diagram is illustrated on Figure 5-4.

Although there have been no commercial applications as yet, indications are that Purox RDF-Gas could be readily accommodated in most industrial or utility burner systems. It would be desirable to have the gas producer located as close as possible to the burner system. Compression power can be a significant drain on the net energy available, therefore modest pressure burner utilization systems should have priority.

Despite the moisture burden (which can be significant and therefore a limiting operations parameter) the potential for disposing of dewatered sludges along with solid wastes, resulting in a dense, essentially inert residue of minimum volume while producing a useful fuel gas, makes this general concept very appealing.

The prototype Purox installation has demonstrated the technical feasibility of this solid waste-to-fuel gas concept and should have provided the developer with essential data for the design of the first commercial installation. If and when this installation is made it is hoped it will be operated on a continuous basis for extended periods and thereby provide the depth of experience of the fuel gas production plant and the fuel user's facility so necessary to instill the confidence required to justify this capital-intensive system.

The Torrax waste gasification system being developed by Carborundum (schematically illustrated in Figure 4-6) is a modification of the high temperature slag tap shaft furance (cupola concept) incinerator design orginally pursued. The thermal driving force within the reactor system is the very high temperature air blast to the hearth, utilizing produced fuel gas for sustaining hearth temperatures and thermal equilibrium. The Torrax mass and energy balance diagram is illustrated in Figure 4-7. The pyrolysis gases are drawn from the reactor at 800°F, but with sensible heat loss in the gas clean-up and associated ductwork, the export fuel gas would be at approximately 550°F, and would have a calorific value of approximately 200 Btu/SCF.

TORRAX FUEL GAS SYSTEM

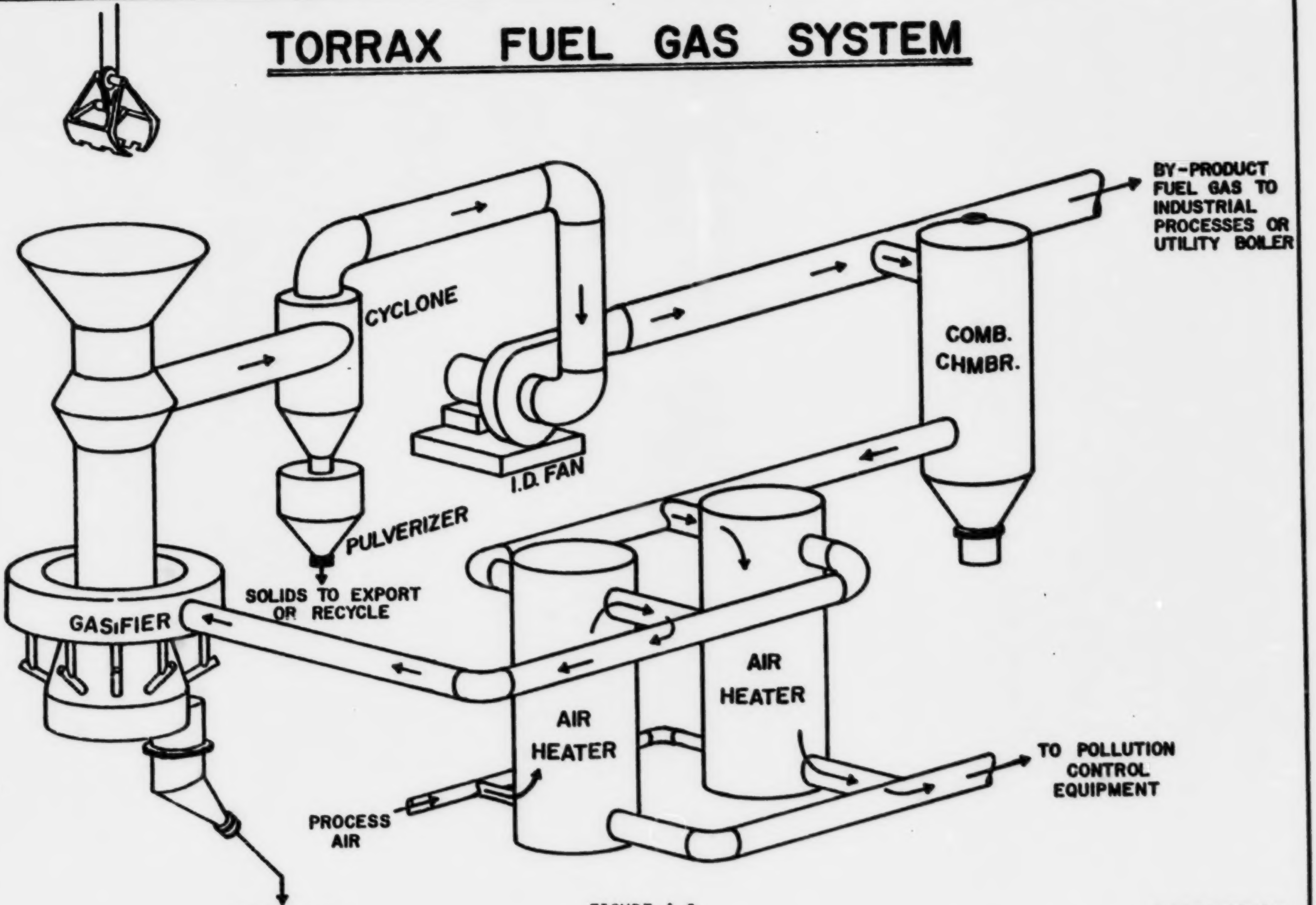

BY-PRODUCT FUEL GAS TO INDUSTRIAL PROCESSES OR UTILITY BOILER
CYCLONE
COMB. CHMBR.
I.D. FAN
PULVERIZER
SOLIDS TO EXPORT OR RECYCLE
GASIFIER
AIR HEATER
AIR HEATER
TO POLLUTION CONTROL EQUIPMENT
PROCESS AIR
INERT SLAG

FIGURE 4-6

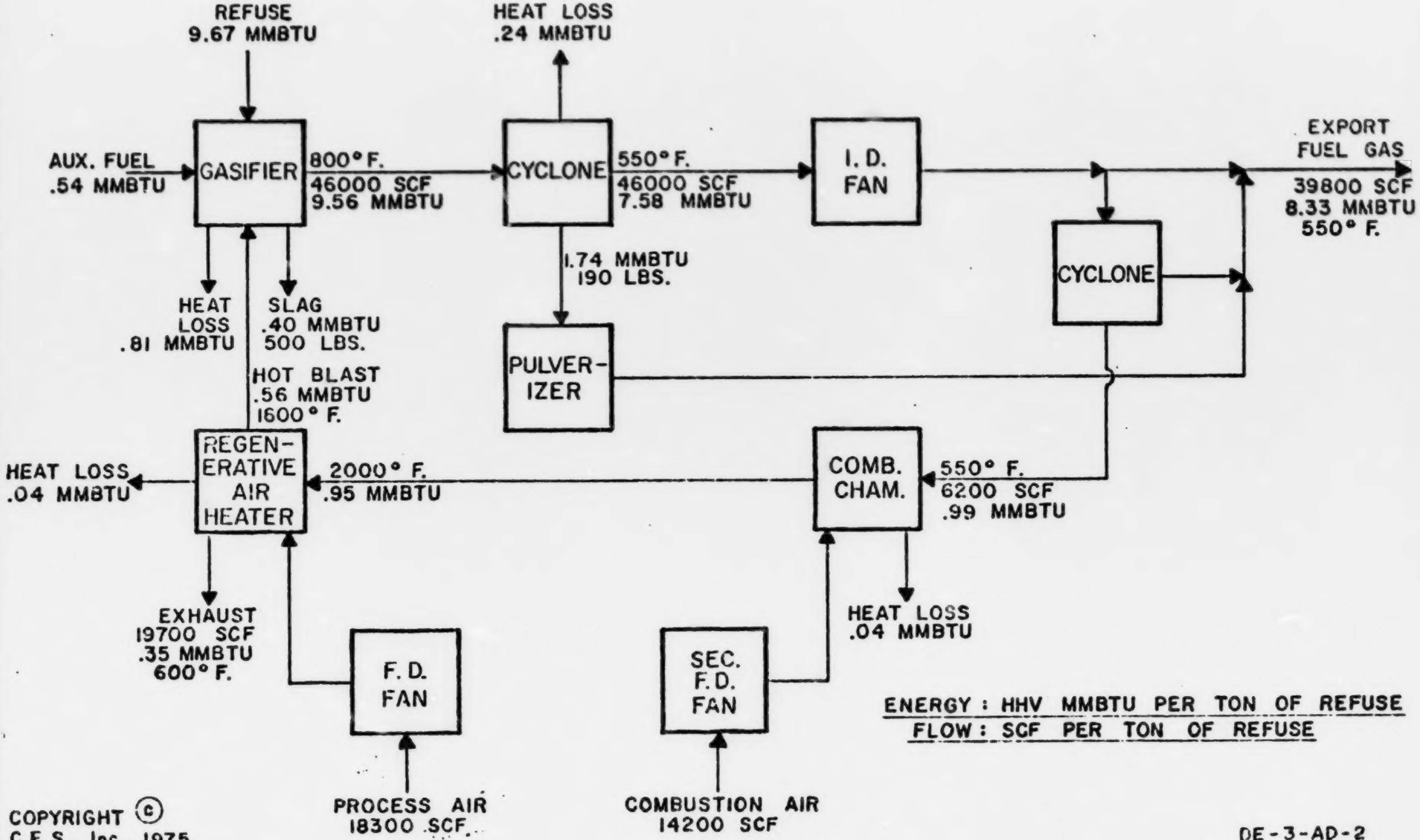
74000·AD·44

4.6-2

TORRAX PYROLYSIS SYSTEM

MASS AND ENERGY BALANCE
300 TPD FUEL GAS SYSTEM

FIGURE 4-7


REFUSE
9.67 MMBTU
AUX. FUEL
.54 MMBTU
GASIFIER
800° F.
46000 SCF
9.56 MMBTU
HEAT LOSS
.81 MMBTU
SLAG
.40 MMBTU
500 LBS.
HOT BLAST
.56 MMBTU
1600° F.
HEAT LOSS
.24 MMBTU
CYCLONE
550° F.
46000 SCF
7.58 MMBTU
1.74 MMBTU
190 LBS.
PULVER-IZER
I. D. FAN
CYCLONE
EXPORT FUEL GAS
39800 SCF
8.33 MMBTU
550° F.
REGEN-ERATIVE AIR HEATER
HEAT LOSS
.04 MMBTU
2000° F.
.95 MMBTU
COMB. CHAM.
550° F.
6200 SCF
.99 MMBTU
HEAT LOSS
.04 MMBTU
EXHAUST
19700 SCF
.35 MMBTU
600° F.
F. D. FAN
PROCESS AIR
18300 SCF
SEC. F. D. FAN
COMBUSTION AIR
14200 SCF

ENERGY : HHV MMBTU PER TON OF REFUSE
FLOW : SCF PER TON OF REFUSE

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DE-3-AD-2

To maximize the recovery of the energy values released, the fuel-using appliance must be in close proximity to the processing plant and be capable of accommodating the 550°F gases. These are essentially made up of:

Dry Gas - 54.4%
Carbonaceous Char - 21.8%
Vaporized Tars - 11.6%
Moisture - 6.7%
Sensible Heat - 5.5%

H_2 - 15%
CO - 14%
CH_4 - 3%
CrH_6 - 1
CO_2 - 10
O_2 - 2
N_2 - 55

The carbonaceous char represents a significant portion of the energy content. It is 77% combustible with volatile matter of 35%, which is suprisingly high. The calorific value can be greater than 9000 Btu/lb. The ash content can be as much as 20%, with a fusion temperature of approximately 1900°F.

Since the combination of carbonaceous char, hydrocarbon vapor/tars (18,000 Btu/lb) and sensible/latent heat comprises 39% of the total energy available in the gases, they must be utilized from the standpoint of energy conservation and economic viability.

A steam-generating system designed specifically to accommodate the composite Torrax fuel produced would probably be required. It should be close-coupled to the reactor system so as to maximize recovery of the sensible and latent heat and avoid condensation in the fuel gas ducting. In view of the carbonaceous solids in this RDF-gas, suitable air pollution control equipment will be required at the flue gas exit from the boiler. If it were possible for the processing system to utilize the energy values of the powdered char in the regenerative stoves to heat the combustion air in lieu of diverting dry product gas for this purpose, not only would more export gas be available for system export but a simpler, more-conventional steam-generating system could be employed. Alternately, perhaps reinjecting the carbonaceous char into the reactor hearth would reduce or even eliminate the need for auxiliary tuyere fuel. No doubt the developer has already tried these obvious approaches and found system contraints unmanageable.

As with the Purox system for gasification, coarse size reduction of as-discarded material would be advantageous. The Torrax system should be capable of processing significant quantities of dewatered sludges with solid waste. The ratio of sludge to solid waste would be a function of moisture content and the quantity of inherent and entrained inert material.

The prototype Torrax system, (75 TPD), originally conceived as a high temperature slag tap incinerator, provided needed insight into the development of a viable reactor chamber, melting hearth, continuous slag tapping process and the basic data for system modification to provide a fuel gas which would result in sustained controlled combustion in a boiler furnace. Protracted continuous operation of a commercial-size facility would be necessary to confirm the performance, reliability and RDF-Gas quality projected.

Included in Appendix D-6 is an excerpt from a report by the Electrical Power Research Institute (EPRI) entitled "Fuels from Municipal Refuse for Utilities: Technology Assessment". The report excerpt also discusses the properties of gaseous as well as solid refuse derived fuels, and their effect on utility boilers.

CHAPTER 5

RESOURCE RECOVERY PROCESSING PLANT REQUIREMENTS

INTRODUCTION

Resource recovery facility requirements will vary widely from plant to plant, depending upon the particular fuel user and secondary materials market requirements. Based on the current potential fuel users of a refuse derived fuel and the existing secondary materials market in Chautauqua County, two types of resource recovery facilities will be examined. One facility will prepare a solid refuse derived fuel (RDF) for use as a solid fuel supplement with coal, in existing boiler systems. The other recovery facility will manufacture a gas via pyrolysis from the wastes for use also as a supplemental fuel in existing boiler systems. The systems examined in this chapter are not site-specific oriented - only general system requirements are explored. Site-specific resource recovery systems are examined in detail in Chapter 7.

SOLID WASTES TO BE PROCESSED

Before proceeding with an analysis of a specific resource recovery system, it is necessary to decide upon what types and quantities of solid wastes could realistically be delivered and processed at such a facility. Referring to Table 2-15 in Chapter II, 1985 waste quantities were used as a basis for analysis, since it would probably be several years before when a resource recovery facility would actually be in operational status. Since the economic success of a resource recovery facility depends upon the sale of the potential energy (heat) in these wastes, only municipal (residential and commercial wastes) and combustible industrial wastes would be accepted at the facility. This should not be too difficult to accomplish, as most of the non-combustible industrial waste is normally collected separately and this was generally substantiated during the field weighing program. Also noteworthy is that this type of waste is often cyclic in nature, depending on manufacturing and/or production cycles and economic conditions. During the weighing survey it was concluded that recorded waste quantities of this category were generally below the usually-expected quantities. Table 2-15, Scheme 5, presents waste quantity data based upon usual conditions. Accordingly, 430 Tpd* - 6 days per week, represents the total average quantity of wastes which potentially could be delivered and accepted at the resource recovery facility. However, a further consideration involves an adjustment in the total potential waste quantity for that portion which is not subject to organized collection and would likely not be delivered to a processing facility, but probably go to landfill. After reviewing previous solid waste management reports and the "Refuse (Solid Waste) Collection & Disposal" survey, completed by the Chautauqua County Planning Department in the spring of 1975, it is estimated that a ten percent reduction in the total waste available would be reasonable. Accordingly, an average of 385 Tpd - 6 days per week is used as that quantity which would be delivered to a recovery facility.

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* Tpd - As used in this report is tons per day, six days per week.

For the purpose of determining the waste quantity to be processed at a resource recovery facility, 385 Tpd is reasonable. There remains, however, the balance of the total 660 Tpd estimated to be generated in the County or 275 Tpd, most of which would require continued land disposal. Figure 5-1 displays the total estimated waste quantity for 1985 by municipality, and that portion of the waste which would be delivered to a resource recovery facility.

The composition of the solid wastes to be processed as outlined in Table 2-15 Scheme 5 is municipal combustible and non-combustible wastes, and industrial combustible wastes only. Table 2-11B, 1985 Waste Component Quantity Summary projections lists annual waste quantities for municipal and industrial wastes by the combustible and non-combustible categories.

The total waste quantity of 108,816 tons per year of combustible wastes plus 23,850 tons per year of non-combustible municipal wastes yields 430 tons per day at 6 days per week. The percentages of the combustible and non-combustible wastes can be derived from Table 2-11B. This will be discussed later in this chapter.

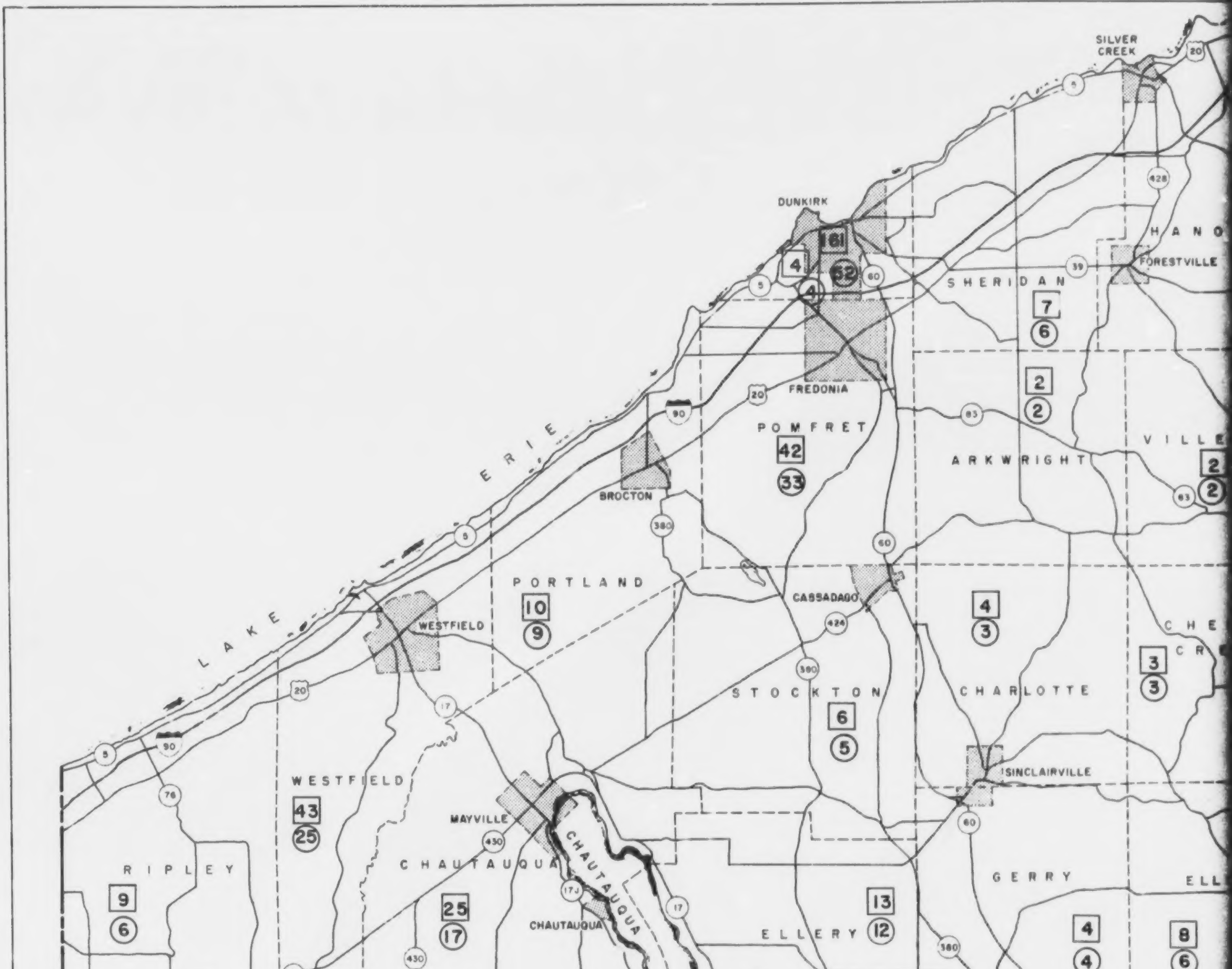
SOLID SUPPLEMENTAL REFUSE DERIVED FUEL FACILITY - GENERAL APPROACH

The approach used to develop a solid RDF processing facility is based on a conceptual analysis of resource recovery. The actual location of the facility, as analyzed in this chapter, has not been determined. However, estimated system costs provide sufficient reserves to adapt the selected alternative to a specific site. This will be discussed in greater detail in Chapter 7. In selecting the various components of the resource recovery facility, the most economical equipment features were included. The following economic parameters are considered:

1. The cost to amortize and operate a resource recovery facility, assuming adverse market conditions. The economics for adverse market conditions will show no sale or credit for ferrous metals, nor any other recovered non-ferrous material. Only the prepared refined fuel fraction will be sold.

2. Costs will be developed for two solid RDF resource recovery facilities, at Jamestown and Dunkirk. This is assuming that there is in fact a potential user in both areas for the solid prepared fuel fraction.

3. Waste transportation costs associated with various resource recovery plant locations will be discussed in Chapter 6. A summary of total resource recovery plant costs and associated waste transport costs is also given in Chapter 6.


LAKE ERIE
SILVER CREEK
DUNKIRK
161
52
4
4
FREDONIA
HANO
FORESTVILLE
SHERIDAN
7
6
2
2
POMFRET
42
33
BROCTON
ARKWRIGHT
VILLE
2
2
PORTLAND
10
9
WESTFIELD
CASSADAGA
4
3
STOCKTON
6
5
CHARLOTTE
3
3
SINCLAIRVILLE
WESTFIELD
43
25
MAYVILLE
CHAUTAUQUA
25
17
CHAUTAUQUA
CHAUTAUQUA
RIPLEY
9
6
ELLERY
13
12
GERRY
4
4
8
6
BEMUS POINT
70
42
6
6
SHERMAN
MINA
3
3
SHERMAN
10
6
NORTH HARMONY
7
7
ELLICOTT
FALCONER
LAKE
CELORON
LAKEWOOD
145
JAMESTOWN
73
2
2
9
5
PANAMA
5
5
CLYMER
HARMONY
BUSTI
23
18
FRENCH CREEK
KIANTONE
3
3
5
20
90
76
430
426
74
17
17J
380
424
60
39
83
63
428
394
62

5.2-a

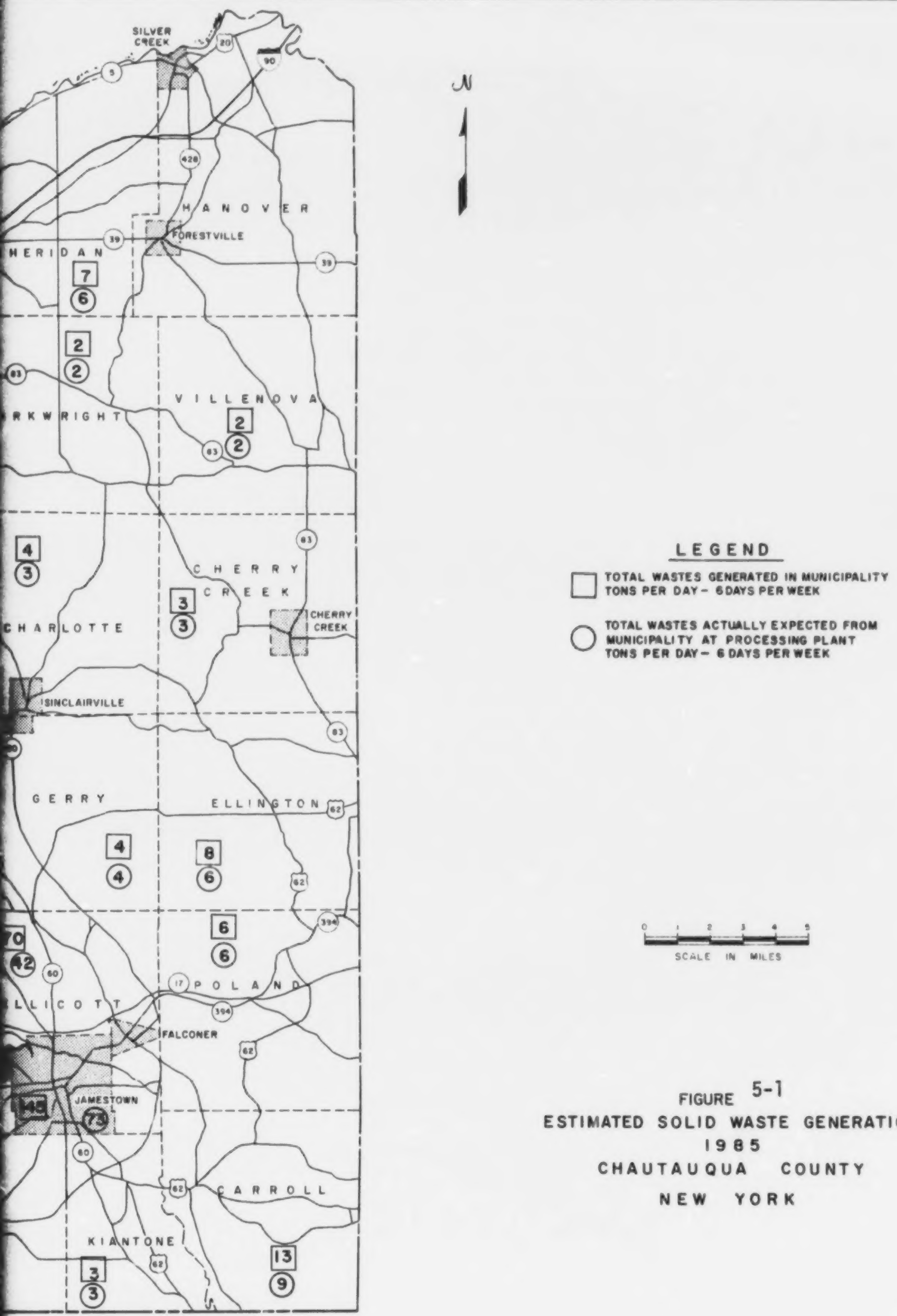

SILVER CREEK
5
20
90
428
HANOVER
FORESTVILLE
39
39
HERIDAN
7
6
2
2
83
RKWRIGHT
VILLENOVA
2
2
83
4
3
83
CHERRY CREEK
3
3
CHARLOTTE
CHERRY CREEK
SINCLAIRVILLE
83
GERRY
ELLINGTON
62
4
4
8
6
62
394
70
42
6
6
60
17
POLAND
394
LLICOTT
FALCONER
62
145
JAMESTOWN
73
60
62
CARROLL
KIANTONE
62
3
3
13
9
N
LEGEND
TOTAL WASTES GENERATED IN MUNICIPALITY TONS PER DAY - 6 DAYS PER WEEK
TOTAL WASTES ACTUALLY EXPECTED FROM MUNICIPALITY AT PROCESSING PLANT TONS PER DAY - 6 DAYS PER WEEK
0
1
2
3
4
5
SCALE IN MILES

FIGURE 5-1
ESTIMATED SOLID WASTE GENERATION
1985
CHAUTAUQUA COUNTY
NEW YORK

SOLID REFINED FUEL FRACTION SYSTEM SELECTED FOR ANALYSIS:

Process Description

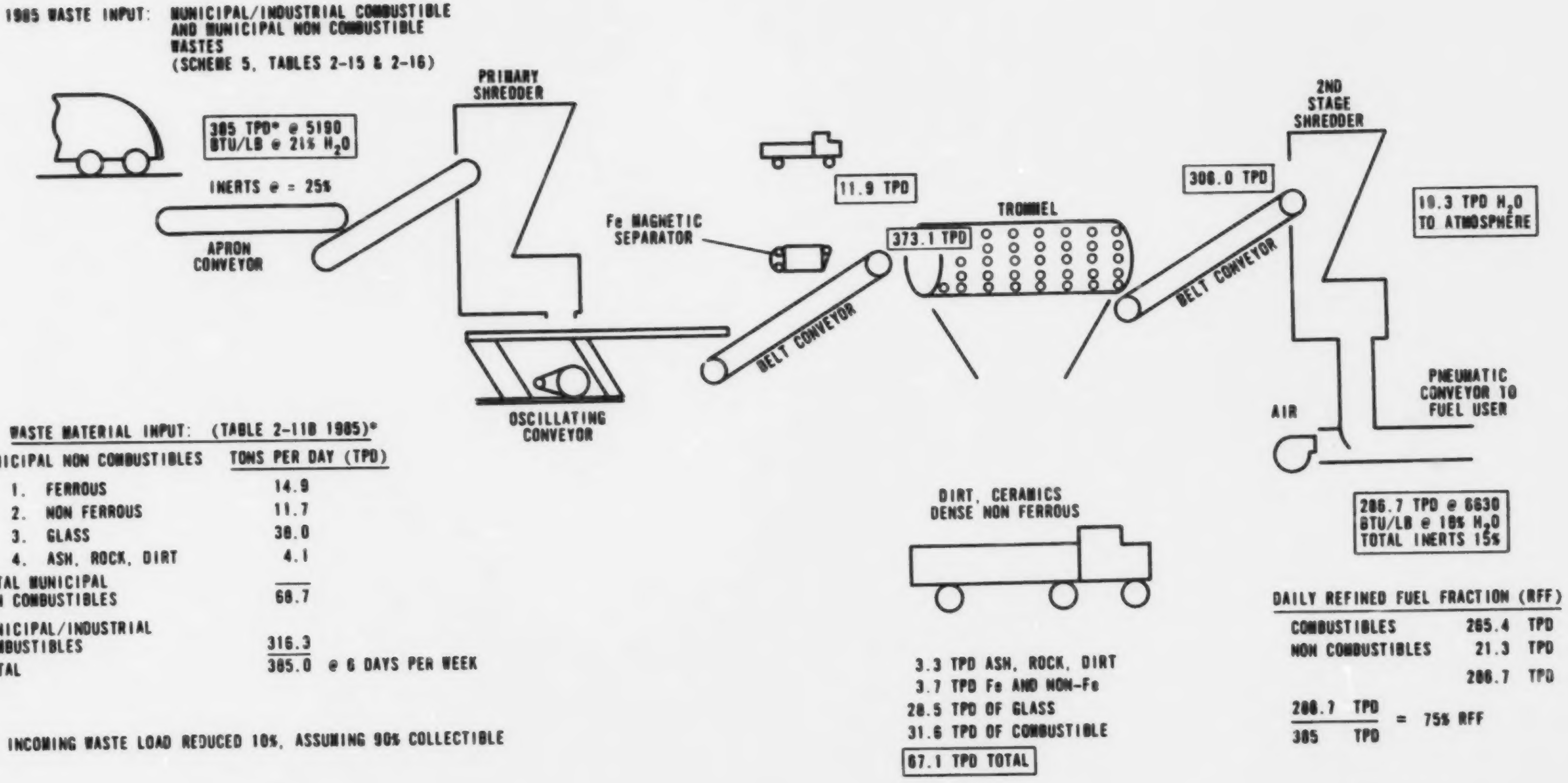
Figure 5-2 "Resource Recovery Analysis Flow Diagram" illustrates the basic recovery system and materials flow through this system which.

Referring to Figure 5-2, the process envisioned would function generally as follows:

Refuse would be delivered to a central receiving area, which would have sufficient capacity to receive all wastes. It should be noted at this time that there are many individuals who currently deliver wastes to the existing landfills in small pickup trucks and automobiles. This waste quantity is included in the 385 Tpd estimate. However, the pertinent factor regarding this waste will be traffic and logistical considerations at a central processing plant. A typical receiving area for wastes and suggested traffic pattern will be discussed and illustrated in more detail in Chapter 6, Figure 6-9.

The waste material will be received continuously onto an apron conveyor. The waste will then be processed in a refuse shredder capable of handling the 385 Tpd in one eight-hour shift. This first processing step would be coarse shredding to reduce the average refuse piece size to about 10 to 12 inches in the largest dimension. The material leaving the shredder would be fed by an oscillating conveyor onto a belt conveyor. A magnetic separator over the belt conveyor would remove much of the ferrous metals, consisting mostly of tin cans, from the waste stream. Such a magnetic separation should have a removal efficiency of about 80 percent. The material would then pass thru a trommel similar to that used in trimming, reducing, and recovering coal. The trommel envisioned would be approximately 10 feet in diameter and 20 to 25 feet in length, with hole sizes of between 1 to 2 inches. The purpose of the trommel is to remove as much as is feasible of the remaining ferrous and non-ferrous metals, glass, rocks, dirt, etc., which would be undesirable in the refuse-derived or "salvaged" fuel. The following assumed separation efficiencies would be achieved in the trommel:

	Material Separated	Assumed Efficiency
1.	Ash, rocks, dirt, etc.	80% removal
2.	Metals	25% of quantity remaining after ferrous separation
3.	Glass	75%
4.	Combustible material	10% of combustible wastes in the waste stream


1985 WASTE INPUT: MUNICIPAL/INDUSTRIAL COMBUSTIBLE AND MUNICIPAL NON COMBUSTIBLE WASTES (SCHEME 5, TABLES 2-15 & 2-16)
385 TPD* @ 5190 BTU/LB @ 21% H$_2$O
INERTS @ = 25%
APRON CONVEYOR
PRIMARY SHREDDER
OSCILLATING CONVEYOR
Fe MAGNETIC SEPARATOR
11.9 TPD
BELT CONVEYOR
373.1 TPD
TROMMEL
DIRT, CERAMICS DENSE NON FERROUS
BELT CONVEYOR
306.0 TPD
2ND STAGE SHREDDER
19.3 TPD H$_2$O TO ATMOSPHERE
AIR
PNEUMATIC CONVEYOR TO FUEL USER
286.7 TPD @ 6630 BTU/LB @ 18% H$_2$O TOTAL INERTS 15%

WASTE MATERIAL INPUT: (TABLE 2-11B 1985)*	
MUNICIPAL NON COMBUSTIBLES	TONS PER DAY (TPD)
1. FERROUS	14.9
2. NON FERROUS	11.7
3. GLASS	38.0
4. ASH, ROCK, DIRT	4.1
TOTAL MUNICIPAL NON COMBUSTIBLES	68.7
MUNICIPAL/INDUSTRIAL COMBUSTIBLES	316.3
TOTAL	385.0 @ 6 DAYS PER WEEK

* INCOMING WASTE LOAD REDUCED 10%, ASSUMING 90% COLLECTIBLE

3.3 TPD ASH, ROCK, DIRT
3.7 TPD Fe AND NON-Fe
28.5 TPD OF GLASS
31.6 TPD OF COMBUSTIBLE
67.1 TPD TOTAL

DAILY REFINED FUEL FRACTION (RFF)		
COMBUSTIBLES	265.4	TPD
NON COMBUSTIBLES	21.3	TPD
	286.7	TPD

$$\frac{286.7 \text{ TPD}}{385 \text{ TPD}} = 75\% \text{ RFF}$$

FIGURE 5-2
CHAUTAUQUA COUNTY, NEW YORK
RESOURCE RECOVERY ANALYSIS
FLOW DIAGRAM
REFUSE DERIVED FUEL PROCESSING SYSTEM

GILBERT ASSOCIATES, INC.
READING, PENNSYLVANIA

It should be emphasized that it cannot be stated, with sufficient confidence for design purposes, that the trommel will perform as indicated. It was selected because it should perform approximately as well as an air classifier and would require a less complex line of equipment, resulting in a more dependable processing system. However, the preceding postulation cannot be substantiated at this time. Accordingly, a sufficient cost allowance has been made for substitution for the trommel by an air classification/separation system, should more detailed investigations, (which would be conducted during design) prove the trommel to be an unattractive means of removing undesirable materials from the waste stream.

The material leaving the trommel would then pass through a second-stage shredder, to reduce the refuse piece size to a maximum dimension of between 1 to 2 inches. This material would then be sufficiently prepared as a refuse derived fuel to be burned in suspension at a steam/electric station such as the Jamestown Board of Public Utilities generating station or the Niagara Mohawk Power Corporation station in Dunkirk.

The waste material input and the quantities of the incoming materials removed at various stages of the system are shown on Figure 5-2. An estimated 5% moisture content reduction occurs as the refuse is processed. This moisture content reduction equates to the 19.3 Tpd shown as being "lost to the atmosphere." The initial refuse heating value shown of 5190 BTU as per pound as shown in Figure 5-2, was presented in Table 2-16 of Chapter II; the rationale used in deriving this value is also discussed in Chapter II. The initial total inerts of the waste prior to processing amounts to approximately 25 percent and the initial moisture content is 21 percent. Converting this to a moisture-and ash-free basis, the incoming waste material has a heating value of 9611 BTU per pound. The output of salvage fuel from the processing plant would, on the average, be 286.7 Tpd, having a moisture content of 16 percent, total inerts of 15 percent and a heating value of 6630 BTU per pound (refined fuel fraction). Of the 15 percent inerts in the refined fuel fraction, 7.6 percent is remaining non-combustible materials not removed in processing and 7.4 percent is ash in the combustible fraction. The refined fuel fraction heating value of 6630 BTU per pound adjusted to a moisture-and ash-free basis again yields 9611 BTU per pound. In terms of the 385 Tpd of waste processed, a refined fuel fraction of 75% of the input is recovered, or 286.7 Tpd. It is proposed that the refined-fuel fraction would be pneumatically conveyed to the fuel user; however, this aspect of the process is quite dependent on site-specific conditions. Detailed investigations of the specific site and fuel user would yield the most desirable method of conveyance to the fuel user. A generous allowance for the process plant cost estimates has been made for conveyance to a potential fuel user, including an allowance for modest surge storage of the fuel should this be necessary to satisfy the user's need.

POTENTIAL SALVAGED FUEL AVAILABLE

The 286.7 Tpd salvage fuel output from the processing plant equates to a gross fuel value @ 6630 BTU per pound to 3,802 MBTU* per day or 13.2 MBTU per ton of RFF. Assuming that the salvage waste fuel (refined fuel fraction, RFF) has a combustion efficiency of 70 percent, the net fuel available for sale is approximately 2,660 MBTU per day or 9.28 MBTU per ton of RFF. This heating value corresponds to approximately 102,100 pph** net steam output, 24 hours per day, 6 days per week; 153,100 pph net steam output, 16 hours per day, 6 days per week; or 205,000 pph net steam output, 12 hours per day, 6 days per week, or 306,300 pph net steam output, 8 hours per day, 6 days per week.

SUPPLEMENTAL STEAM FROM SOLID REFUSE DERIVED FUEL SUMMARY(a)

RFF Utilization Period	Supplemental Steam
24 hours	102,100 pph
16 hours	153,100 pph
12 hours	205,000 pph
8 hours	306,300 pph

(a) 286.7 tons of RFF @ 70% combustion efficiency @ 6630 BTU/LB, 6 days per week.

Figure 5-3 compares the value of a refuse derived fuel (RDF) to that of fossil fuel. The values derived are based on a combustion utilization efficiency of RDF at 70 percent and fossil fuel utilization efficiency at 85 percent. The relative RDF-to-fossil fuel utilization efficiency is 82 percent. Figure 5-3 illustrates the relationship between various assumed fuel costs per million BTU and the corresponding revenue per ton of unprocessed refuse received (385 Tpd) and processed refuse (RFF @ 286.7 TPD). More simply stated, for the processed refuse heating value of 6630 BTU per pound, the revenue per ton of refuse processed or unprocessed can be obtained if the processed refined fuel fraction from the processing plant were sold to the user at the indicated fuel values per million BTU. For example, if the fuel user would pay $1.00 per MBTU for the RDF, this would mean that this RDF value would correspond to a potential income of $8.12 per ton of refuse accepted at the recovery facility or $10.88 per ton of RDF sold to the fuel user.

Regarding the possible sale of recovered ferrous metals as stated early in this Chapter, it was elected to assume adverse market conditions for this analysis and accordingly these materials would be landfilled. However, provision has been made in the process for ferrous separation should changed market conditions show a demand for this material. It is not optimistic at the present time, that recovered ferrous metals from the process would be of much value. This observation is somewhat substantiated

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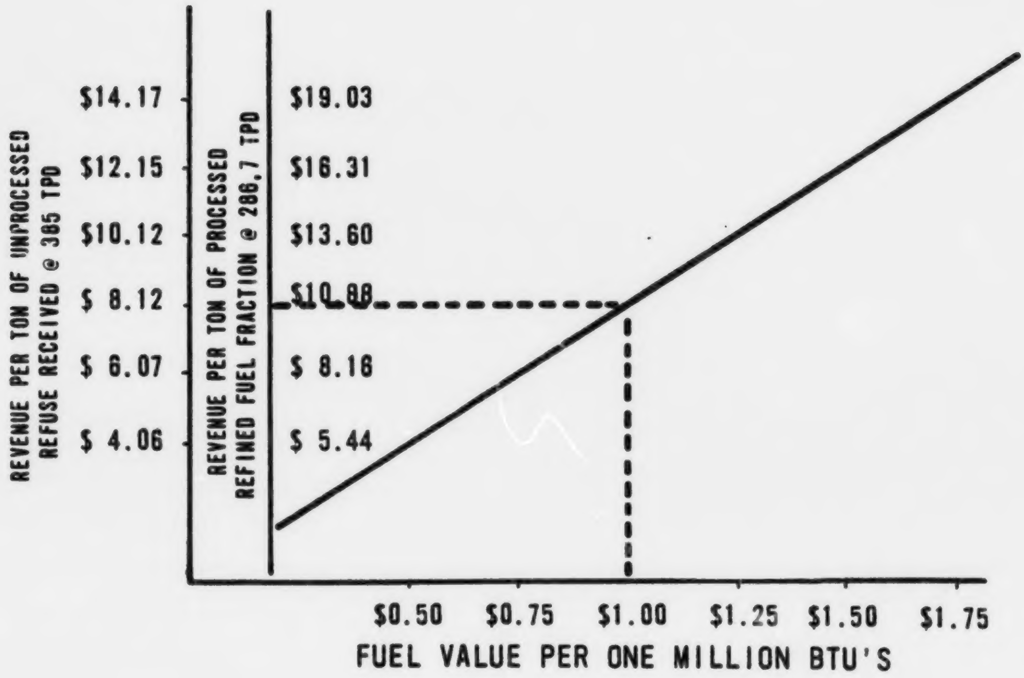
* Million BTU
** pounds per hour



NOTE:

VALUES DERIVED ASSUME

REFUSE DERIVED FUEL (RDF) UTILIZATION EFFICIENCY OF 70%
FOSSIL FUEL UTILIZATION EFFICIENCY OF 85%
THEREFORE RELATIVE FUEL UTILIZATION FACTOR IS .82
REFINED FUEL FRACTION @ 6630 BTU/LB

FIGURE 5-3
REFUSE DERIVED FUEL VALUE
PER TON OF REFUSE RECEIVED AND
PER TON OF REFINED FUEL FRACTION
CHAUTAUQUA COUNTY, N.Y.

GILBERT ASSOCIATES, INC.

by a reported price per gross ton of No. 1 heavy melted steel bundles of $60 in July, 1975.* Thus, no revenue from the sale of recovered ferrous metals has been made for the economic analysis.

ESTIMATED PROCESSING PLANT COSTS

Tables 5-1, 5-2 and 5-3 respectively display the estimated capital, operating and total cost per ton associated with processing the 385 Tpd of refuse in the system shown in Figure 5-2. The total estimated capital outlay for a 385 Tpd central facility is $4,459,000 in terms of current day (October, 1975) costs. For this analysis, the building and equipment and boiler modifications have been amortized over 10 years at a 7% interest rate. For the purpose of this preliminary economic evaluation, the preceding amortization basis is a reasonable one, although if this were a final cost estimate it might be desirable to amortize the building over a 20 year period, which would yield somewhat of a lower cost per ton to own and operate (estimated as about a $0.75/ton reduction). Also contingency is included.

The annual estimated operating cost of $613,700 shown in Table 5-2 includes the following breakdown for labor which is a major part of the operating cost:

1	Plant Manager
2	Process Equipment Operators
2	Front End Loader Operators/Truck Drivers
1	Weighmaster
2	Laborers
2	Mechanic/Maintenance Man
1	Clerk

The above complement of personnel should be sufficient to operate the facility on a 6 day per week basis; personnel to haul away plant residue are included.

Thus, the total estimated cost per ton to amortize and operate the central recovery facility is $12.40 per ton of refuse processed. This figure excludes any credits for salvaged fuel sold, landfill salvage, and haul cost considerations.

TWO RESOURCE RECOVERY PLANT CONFIGURATIONS

As described in the preceding section, the estimated cost to own and operate one central recovery facility in Chautauqua County is $12.40/ton. Since there is a greater haul distance associated with one central recovery facility as compared with two such facilities, the economics of two processing/recovery facilities are also explored - one to be located in the Jamestown area, the other in the Dunkirk area. The capital and operating disadvantages of two facilities versus one central facility will be compared, with the respective haul cost savings, in Chapter 6. The

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* Reported in the "American Metal Market/Metal Working News," July 7, 1975.

TABLE 5-1

CAPITAL COST ESTIMATE*
RESOURCE RECOVERY FACILITY
385 TONS PER DAY

PROCESSING/RECOVERY PLANT

I. BUILDING

1.	Land Acquisition		$ 60,000
2.	Site Preparation, Grading, etc.		120,000
3.	Building, foundations, scale		662,000
4.	Electrical		280,000
5.	Utilities, plumbing, etc.		70,000
		Subtotal	$1,192,000

II. Processing Equipment - Installed

1.	Primary Shredder w/feed & take away oscillating conveyor		425,000
2.	Intermediate Conveyors - Into and Out of Trommel		94,000
3.	Magnetic Separator		65,000
4.	Trommel		125,000
5.	Second Stage Shredder		190,000
6.	Allowance for pneumatic feed and surge storage		260,000
7.	Dust Control System		85,000
		Subtotal	$1,244,000

III. Refuse Receiving and Handling Facility

1.	Receiving Waste Pit Conveyors and cross feed conveyor		125,000
2.	Construction of Refuse Receiving Pit and associated accessories		50,000
3.	Transportation truck for roll on/roll off containers		55,000
4.	Two 40 C.Y. roll on/roll off open top waste containers for Processing Plant residuals		14,000
5.	Three 40 C.Y. roll on/roll off open top waste containers. Two for auto delivered wastes plus one spare		21,000
6.	Front end loader and accessories		120,000
		Subtotal	$ 385,000

*Based on Current Day October 1975 Costs

TABLE 5-1 (Cont'd)

CAPITAL COST ESTIMATE

IV.	Boiler Modifications	Subtotal	$ 550,000
	Subtotal Item I, II, III & IV		3,371,000
	Construction Contingency - 15%		506,000
	Engineering, Supervision & Admin. 15% of total		582,000
		TOTAL	$4,459,000

TABLE 5-2

ESTIMATED ANNUAL RESOURCE RECOVERY FACILITY OPERATING COSTS
385 TPD - SIX DAYS/WEEK*

1.	Labor - 11 personnel for one eight hour shift/day - 6 days/week	$150,500
	35% allowance - benefits, overtime	53,000
	Subtotal	$203,500
2.	Maintenance & Repair - parts replacement etc.	
	Facility-Building etc.	$ 10,000
	Equipment	135,000
	Subtotal	$145,000
3.	Heating, Water, and Miscellaneous Supplies	$ 20,000
4.	Fuel, Maintenance & Repair Front End Loader, Residual Hauling Truck and Containers	$ 40,000
5.	Electric Power	$100,000
6.	Processing Facility Residue Disposal Costs	$ 89,100
7.	Sinking fund for Residue Haul Truck and Containers @ 5.5% for 5 years ($90,000)	$ 16,100
	Total Annual Estimated Plant Operating Costs	$613,700

* 282 operating days per year

TABLE 5-3

ESTIMATED COST PER TON OF REFUSE PROCESSED TO OWN AND OPERATE RESOURCE RECOVERY FACILITY

			Annual Cost
1.	Estimated Total Debt Service @ 10 years 7% ($4,459,000)		$ 634,900
2.	Coverage @ 15%		$ 95,300
3.	Estimated Annual Operating Cost		$ 613,700
		TOTAL	$1,343,900

Estimated Average Annual Refuse Processed in 1985-385 TPD @ 282 Operating Days per year yields 108,570 tons per year

Estimated Cost Per Ton to Amortize and Operate Resource Recovery Facility

$$\frac{\$1{,}343{,}900}{108{,}570\text{ TPY}} = \$12.40/\text{ton}*$$

*Does not include credits from sale of RDF or N.Y.S.D.E.C. construction grant.

allocation of wastes delivered to these two recovery facilities was estimated to be 211 Tpd to the facility located in the Jamestown area and 174 Tpd to the facility located in the Dunkirk area. For analysis, it is assumed that there is a fuel user for solid RDF in both the Jamestown and Dunkirk area.

It can be concluded that, for the preceding quantities of refuse to be processed in the two facilities, essentially the same line and type of equipment as displayed in Figure 5-2 would be required. There could be some reduction in the costs shown in Tables 5-1, 5-2 and 5-3 in capital costs associated with the building and some reductions in power consumption associated with the reduced quantities to be processed. It is estimated that the preceding reduction would result in an annual amortizing and operating cost for either of the two processing plants of $1,208,800/year in lieu of the $1,343,900/year to own and operate the one central facility. The estimated cost per ton to own and operate two resource recovery facilities in the county, one in the Jamestown and one in the Dunkirk area is shown in Table 5-4. The costs per ton illustrated are comparable to the $12.40/ton to own and operate one central recovery facility.

TABLE 5-4

ESTIMATED COST TO OWN AND
OPERATE TWO RESOURCE RECOVERY FACILITIES

	Jamestown Area Recovery Facility (211 Tpd)*	Dunkirk Area Recovery Facility (174 Tpd)*
Total Estimated Annual Cost	$ 1,208,800	$ 1,208,800
Annual Tonnage	59,500	49,070
Estimated Cost/Ton To Own & Operate	$ 20.30	$ 24.65

* Tonnage received at the recovery facility per day @ 282 operating days per year

As illustrated in Table 5-4, the cost per ton to amortize and operate two facilities is significantly higher than the cost for one central facility.

PYROLYSIS GAS SUPPLEMENTAL REFUSE DERIVED FUEL FACILITY

Process Description; Purox System

Referring to the two pyrolysis processes discussed in Chapter 4, the Torrax and Purox systems, it appears that the most desirable system for Chautauqua County would be the Purox system by Union Carbide, for the reasons outlined in Chapter 4.

Figure 5-4 provides a schematic flow of the basic Purox single modular system envisioned for Chautauqua County, consisting basically of a single modular 350 ton-per-day facility. The material mass flows indicated in Figure 5-4 are based on relative percentages of a 350 ton-per-day Purox facility.

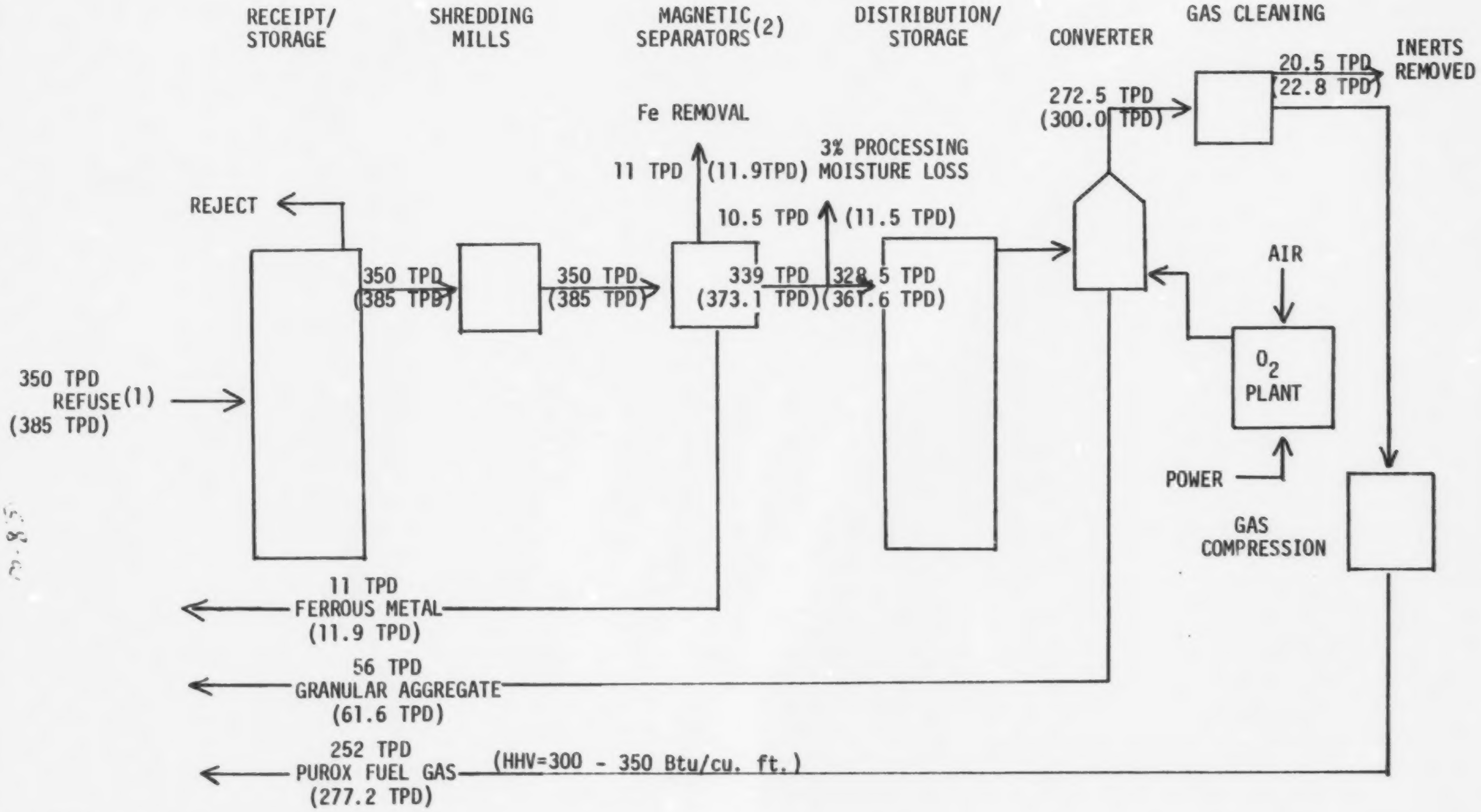
It is assumed for this analysis that 350 per day of processable wastes will be delivered to the Purox one-module facility. Also it is assumed that the facility will operate on a six day per week, 282 operating day per year basis. This could be done by "banking" the furnace or converter of the system for the seventh day of the week when there is no refuse. The banking would only be for one day until Monday. Since it is anticipated that the fuel user will have outages for repair and maintenance of his facilities for about 30 days per year, (excluding the one day per week when the converter is banked), the total operating days are 282 per year. Also, during the user outage maintenance period, the Purox annual 15-20 day required maintenance would be scheduled.

As previously described for the said RDF processing facility, the refuse would be delivered to a central refuse receiving area, illustrated in Figure 6-9. Waste material would then be conveyed continuously to the Purox facility over a twenty-four hour period. There will be sufficient storage at the refuse receiving area to allow for the 16 hours of waste processing after the normal 8-hour waste delivery period. This will be discussed further in Chapter 6.

In the beginning of the Purox process the waste stream is first fed into a hammermill, where it is shredded to six inches or less in piece size. Then the shredded material is passed below a magnetic separator for ferrous metals removal. The shredded refuse is then compacted into 14-inch diameter pellets by ram injection and fed into the oxygen refuse converter, where the actual gasification of the wastes takes place.

The refuse converter is rated at 330 to 350 tons per day. However it would only be guaranteed for 80 percent of that value, or 265 to 280 tons per day, including all "down time". Examining the quantities given in Figure 5-4, it can be seen that, after shredding and magnetic separation, there is less material to process, due to ferrous removal and moisture loss. As a result, the one-module unit rated at 350 tons per day could possibly handle all but approximately 12 tons, assuming moisture losses of only three percent.

Oxygen of 95 percent purity enters the refuse converter near the bottom and provides the necessary thermal force to maintain temperatures ranging from 2400° to 3100°F. At this temperature all of the noncombustible materials fuse into molten slag, which is tapped continuously and allowed to flow into a water quench tank forming a granular aggregate or grit. The hot combustion gases rise through descending wastes, pyrolyzing organic materials into gases, liquids and char. Gases exit the converter and pass through a gas-cleaning operation consisting of a wet scrubber, electrostatic precipitator, and acid absorber and condenser. Wastewater from the condenser operation contains a high Biochemical Oxygen Demand (BOD),


RECEIPT/ STORAGE
SHREDDING MILLS
MAGNETIC SEPARATORS(2)
DISTRIBUTION/ STORAGE
CONVERTER
GAS CLEANING
INERTS REMOVED
20.5 TPD (22.8 TPD)
272.5 TPD (300.0 TPD)
Fe REMOVAL
11 TPD (11.9TPD)
3% PROCESSING MOISTURE LOSS
10.5 TPD (11.5 TPD)
REJECT
350 TPD (385 TPD)
350 TPD (385 TPD)
339 TPD (373.1 TPD)
328.5 TPD (361.6 TPD)
AIR
O_2 PLANT
POWER
GAS COMPRESSION
350 TPD REFUSE(1) (385 TPD)
11 TPD FERROUS METAL (11.9 TPD)
56 TPD GRANULAR AGGREGATE (61.6 TPD)
252 TPD PUROX FUEL GAS (277.2 TPD)
(HHV=300 - 350 Btu/cu. ft.)

(1) Refuse @ 25% inerts and 21% moisture
(2) Consisting of 3.9% ferrous material:
@ 385 TPD = 14.9 TPD
@ 350 TPD = 13.7 TPD
Magnetic separator
80% efficient

FIGURE 5-4 FLOW CHART, PUROX SYSTEM FACILITY AT 350 AND 385 TONS PER DAY

Gilbert/Commonwealth

ranging from 30,000 - 50,000 ppm. This is however biodegradable and the cost estimates have included treatment of this wastewater to a level of 200 ppm BOD. From the gas-cleaning train, the gas is compressed for delivery to the fuel user.

The product gas has a heating value of approximately 300-350 BTU/scf[a], and will be of high purity and flow temperature. To burn the Purox gas, the only significant modification anticipated for the fuel user (assuming an existing gas fired boiler is being utilized) is to enlarge the burner inlet. Stack emissions are clean compared to fuel oil, since impurities have been removed. Therefore when the Purox gas is used as a fuel supplement on an existing gas, oil or coal-fired boiler unit, stack emissions and flyash should not be of concern.

POTENTIAL ENERGY AVAILABLE AND PUROX GAS AND SOLID RDF "CREDIT" POTENTIAL

The Purox process recovers approximately 7.5 MBTU per ton of municipal solid waste processed, or approximately 2890 MBTU per day @ 385 tons, gross value, or 2625 MBTU per day @ 350 tons, gross value. This compares with the solid refuse derived fuel at 13.2 MBTU per ton of Refined Fuel Fraction (RFF) or 3802 MBTU per day @ 385 tons (286.7 tons RFF), gross value. If a combustion efficiency of 70 percent is given to the solid RDF, the net available energy from solid RDF is 9.28 MBTU/ton of RFF or 2660 MBTU per day @ 385 tons (286.7 ton RFF). Assuming the pyrolysis gas has a combustion efficiency of 70 percent, the net available energy from the Purox gas is 5.25 MBTU per ton of municipal solid waste processed or 2022 MBTU per day @ 385 tons, or 1840 MBTU per day @ 350 tons.

ENERGY AVAILABLE FROM PUROX GAS AND SOLID RDF

Type of RDF	Daily Refuse Tonnage Available	Net Energy Available Per Ton Received[b]	Total Daily Energy Available
Gas	350	5.25 MBTU	2022 MBTU
Solid	287[a]	9.28 MBTU	2660 MBTU

[a] Refined fuel fraction after processing through resource recovery plant. Initially, will start with 385 tons per day @ 75% RFF yields 287 tons per day.

[b] Assuming combustion efficiency of 70%.

Comparing the value of the Purox gas to that of a fossil fuel, it is assumed that a combustion utilization efficienty of the Purox gas is 70 percent and fossil fuel is 85 percent. This gives a ratio or relative

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[a] scf - standard cubic foot

Purox gas to fossil fuel utilization factor of 0.82 (70%/85%), the same as for the solid RDF. The reason that a 70 percent utilization efficiency is assumed for the Purox gas, and not 80-85 percent, is that the Purox gas has not yet been utilized to determine its utilization efficiency compared to other fossil fuels. Maintaining a conservative posture, therefore a 70 percent value was assumed.

The Purox gas at 7.5 MBTU per ton of solid waste processed and a relative utilization fuel factor of 0.82 yields 6.15 MBTU per ton of waste processed. If coal or other fossil fuel is worth $1.00 per MBTU, the Purox gas has a value of 6.15 MBTU times $1.00 per MBTU or $6.15 per ton of waste processed. At 350 tons per day, the per-day value of the Purox gas @ $1.00 per MBTU is $2,153.

If Purox gas credits are compared with the solid RDF at 6630 BTU/lb refined fuel fraction @ 0.82 relative fuel utilization factor, this yields 10.88 MBTU/ton of refined fuel fractions, which at 385 tons per day is 286.7 tons per day of RFF. Thus at $1.00 per MBTU, one ton of solid RFF equals to $10.88 per ton RFF ($8.10 per ton received @ 385 TPD) or $3,120 per day, compared to $2,153 per day for Purox gas or about 31% more "revenue" potential per day for the solid RDF than the Purox gas.

Even if the combustion efficiency of the Purox gas was assumed to be 85 percent, the same as fossil fuel, it would yield a relative fuel utilization factor of 1.0. This would mean that 7.5 MBTU per ton of waste processed for the Purox gas would yield @ $1.00 per MBTU, $7.50 per ton of waste or $2625 per day at 350 tons per day. Compared to the solid RDF at $3120 per day (solid RDF) it still yields about 16% more "revenue" potential per day than the Purox gas.

ESTIMATED PUROX PLANT COSTS

The estimated capital and annual owning costs for a 350 ton per day Purox facility are given in Table 5-5. The total estimated capital outlay is $18,799,400. Included in this cost is the Purox facility, a refuse receiving facility plus building, land acquisition and development, and boiler modifications. Although the cost of modifying boilers will vary from user to user and should be less than the solid RDF boiler modifications, the same capital outlay of $550,000 was allocated, for safety. An amortization period of 10 years at 7 percent is used to determine the annual capital cost. Annual operating costs include the cost for residue disposal of ferrous metal and aggregate, assuming adverse material market conditions. The estimated cost per ton to own and operate the Purox facility on a 6 day per week basis, 282 operating days per year, is $46.40 per ton of refuse processed. This figure excludes any credits for gas sold, landfill salvaged, haul costs considerations, or ferrous and aggregate sale. If the entire capital costs were amortized over 20 years instead of 10 years, it would result in a reduction of approximately $7.00 per ton, thus yielding $39.40 as the cost per ton of refuse processed.

TABLE 5-5

ESTIMATED PUROX PLANT COSTS
350 TON PER DAY FACILITY

Capital Costs		
1.	Purox Plant Facility	$ 13,000,000
2.	Land Acquisition and Site Development	180,000
3.	Refuse Receiving and Handling Facility	485,000
4.	Boiler Modifications	550,000
	SUBTOTAL	$ 14,215,000(a)
5.	Construction Contingency @ 15%	2,132,300
6.	Engineering, Supervision & Administration @ 15%	2,452,100
	TOTAL	$ 18,799,400
Annual Operating Costs		
1.	Debt Service @ 7% 10 years	$ 2,676,700
2.	Operating Costs	1,900,000
	TOTAL	$ 4,576,700

Process @ 350 TPD, 282 DPY
98,700 ton per year

Estimated amortization and operating cost per ton: $\frac{\$4,576,700}{98,700 \text{ TPY}}$ = $46.40/ton(b)

(a) Does not include potential cost for conveyance of gas to fuel user. This must be determined for site specific conditions. Refer to Chapter 7.

(b) Does not include revenue from sale of gasified RDF or the N.Y.S.D.E.C construction grant.

SOLID AND PYROLYSIS GAS RDF FACILITY COST COMPARISON

Table 5-6 provides a cost summary of the solid fuel and pyrolysis gas systems. Comparing the estimated capital cost of $4,459,000 for the solid RDF facility to the Purox facility at an estimated $18,799,400, the Purox facility is approximately 420% higher in initial capital outlay.

The annual cost comparison of the solid RDF facility at $1,343,900 to the Purox facility at $4,576,700 amortized at 7% for 10 years, indicates that the Purox facility is approximately 340% higher in annual operating costs. If the Purox costs are amortized over 20 years and compared to the solid RDF facility amortized over 10 years, both at 7%, the Purox system is still approximately 270% higher in annual operating costs.

The estimated cost per ton of the solid RDF facility is $12.40, whereas the Purox facility is $46.40 per ton, approximately 375% higher than the solid RDF facility. The reason for the greater percent difference in the annual operating cost at 340% and the cost per ton of 375% for the Purox system is that the solid RDF facility processes more wastes per day than the Purox facility, thus accounting for the higher percent difference when converting an annual operating cost to a cost per ton.

Estimated potential revenue is calculated on the assumption that the potential use of the refuse derived fuel would pay 75 percent of his existing fuel costs for the salvaged fuel. This is the condition that the Jamestown Board of Public Utilities has expressed for accepting refuse-derived fuel. (Refer to Appendix H.) The BPU annual average cost for one ton of coal was $28.28, per the 1975 Jamestown Board of Public Utilities Annual Report. Assuming the average energy value of the coal was 12,500 BTU per pound, this translates to $1.13 per MBTU (million BTU). As it turns out, the $1.13 per MBTU is also the average cost for fuel at the Niagara Mohawk Dunkirk Station, according to the November, 1975 Federal Power Commission fuel reports. Therefore, the economic considerations discussed herein will also pertain to the Niagara-Mohawk Dunkirk power generating station. At 75% this equates to $0.85 per MBTU, the amount to be paid for a refuse derived fuel supplement by the fuel customer, either the Jamestown B.P.U. or Niagara-Mohawk.

Assuming the previously discussed revenue posture, the anticipated revenue for a solid RDF at 10.88 MBTU per ton RFF yields $9.25 per ton of Refined Fuel Fraction (286.7 TPD). This equates to $6.90 per ton revenue at 385 TPD received. The potential revenue anticipated for the Purox gas is $5.23 per ton received (350 TPD) which is 24 percent less revenue than the solid RDF revenue on a per ton basis. On a daily basis, however, the Purox facility provides 31 percent less revenue, since the solid RDF facility processes more tonnage daily.

The estimated cost per ton to construct and operate the solid and Purox RDF facilities, deducting revenues, is $4.35 per ton and $41.17 per ton, respectively. This translates to estimated total costs of $2,120 per day for the Solid RDF facility at 385 TPD and $14,410 per day for the Purox gas facility at 350 TPD, resulting in 680 percent higher daily costs for the Purox facility.

TABLE 5-6

SOLID RDF AND PYROLYSIS GAS RDF FACILITY COST COMPARISON

		Solid RDF Facility @ 385 TPD	Purox Pyrolysis Gas Facility @ 350 TPD	Percent Comparison Purox System to Solid RDF System
1.	Estimated Capital Cost	$ 4,459,000	$18,799,400	420% higher
2.	Estimated Annual Owning and Operating Cost	$ 1,343,900	$ 4,576,700	340% higher
3.	Estimated Cost Per Daily Tons	$ 12.40	$ 46.40	375% higher(1)
4.	Estimated Potential Revenue @ $0.85 per MBTU(2)	- $6.90(3) per ton - $2,655 Daily	- $5.23(4) per ton - $1,830 Daily	24% less revenue/ton 31% less revenue/ton
5.	Estimated Cost Per Ton of Operation with Revenue Credits	$ 5.50	$ 41.17	750% higher
6.	Total Estimated Daily Cost to Own and Operate with Revenue Credits	$ 2,120	$ 14,410	680% higher

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(1) The reason for the greater percent difference in the cost per ton (375%) and the annual owning and operating cost (340%) is that the solid RDF facility processes additional tonnage annually.

(2) Assume fuel user will pay 75% of his cost for fuel. Therefore, if the user fuel costs are averaging $1.13 MBTU, 75% equals $0.85/MBTU.

(3) For Solid RDF assume 10.88 MBTU per ton of Refined Fuel Fraction which is 286.7 TPD. This yields a revenue of $9.25/ton @ 286.7 TPD, RFF or $6.90/ton revenue @ 385 TPD received.

(4) For the Purox gas assume 6.15 MBTU per ton of refuse processed per day or 350 TPD.

Including the New York D.E.C. construction grant of 50 percent on the Capital Costs of the facilities, the costs with the grant are illustrated in Table 5-7. The Annual Costs for both the solid and Purox gas facilities are reduced, after taking the indicated "Revenue Credit" for the sale of the fuel fraction. The daily operating cost is $815 or $2.11 per ton for the solid RDF facility and $10,400 per day or $29.60 per ton for the Purox system.

Since the Purox system is still significantly higher in cost to operate than the solid RDF facility, the economics of a Purox facility are examined further, assuming a 100 percent construction (Capital Cost) grant was made available. The result is given in Table 5-8. In this consideration, the only local cost is to operate the facility, which, after taking the appropriate fuel "Revenue Credit", resulted in a daily operating cost of $4,900 or $14.00 per ton of waste received. This is 660 percent higher to operate than the solid RDF facility at $2.11 per ton, and 255 percent higher to operate than the solid RDF facility at $5.50 per ton (without 50% construction grant).

From the preceding economic analysis, it is obvious that the Purox system at 350 tons per day is very much higher in cost for the options examined when compared to the solid RDF system. Although the Purox system is examined further in Chapter 7, Site Specific Energy Recovery Schemes for Chautauqua County, it is noted here that the Purox system is not currently considered economically viable unless a 100 percent capital construction grant, with a significant operating subsidy, is made available.

TABLE 5-7

SOLID RDF AND PYROLYSIS GAS RDF FACILITY TOTAL COST SUMMARY WITH NYDEC CONSTRUCTION GRANT

		Solid RDF Facility @ 385 TPD*	Purox Pyrolysis Gas Facility @ 350 TPD*
1.	Estimated Capital Cost	$ 4,459,000	$18,799,400
2.	50% Construction Grant from New York State D.E.C.	- 2,229,500	- 9,399,700
3.	Capital Cost Local Share	$ 2,229,500	$ 9,399,700
4.	Annual Costs		
	- Debt service @ 7% 10 years	$ 317,500	$ 1,388,300
	- Coverage @ 15%	47,600	200,800
	- Operating	613,700	1,900,000
	TOTAL	$ 978,800 ($9.00 per ton)	$ 3,439,100 ($34.85 per ton)
5.	Estimated Annual Potential[1] Revenue @ $0.85 per MBTU	$ 749,000	$ 516,200
6.	Estimated Annual Cost to Operate Including Revenue Credits	$ 229,800	$ 2,922,900
7.	Estimated Daily Cost @ 282 DPY	$815	$10,400
8.	Estimated Cost Per Ton (Received)	$2.11	$29.60

* Include general facilities and operating costs, not site specific conditions costs. These are developed in Chapter 7.

TABLE 5-8

PUROX GAS RDF FACILITY COST SUMMARY ASSUMING 100 PERCENT CONSTRUCTION GRANT AVAILABLE

			Purox Gas Facility @ 350 TPD*
1.	Estimated Capital Costs		$ 18,799,400
2.	100% Construction Grant		18,799,400
3.	Capital Cost - Local Share		$ 0
4.	Annual Costs:		
	- Debt service		$ 0
	- Operating		1,900,000
		Total	$ 1,900,000
5.	Estimated Annual Potential Revenue @ $0.85 per MBTU		$ 516,200
6.	Estimated Annual Cost to Operate including Revenue Credit		$ 1,383,800
7.	Estimated Daily Cost @ 282 DPY		$ 4,900
8.	Estimated Cost Per Ton (Received)		$14.00

CHAPTER 6

WASTE TRANSPORTATION SCHEMES FOR VARIOUS RESOURCE RECOVERY PROCESSING PLANT LOCATIONS

INTRODUCTION

A major cost component of a resource recovery facility is the haul cost associated with transporting wastes to the recovery plant. In this chapter several waste transportation schemes are analyzed. Transfer stations are included in a few of the schemes discussed. Also included for each waste transport scheme is the cost of transporting waste residuals (processed plant rejects) from the resource recovery facility to a sanitary landfill for ultimate disposal. Wastes are allocated by town for delivery to designated central receiving points for each waste transport scheme considered. Waste transport costs are also developed for wastes not intended for inclusion at the resource recovery facility - industrial non-combustible wastes. The waste transport costs can be classified into two categories: (1) the Direct County Cost and (2) total Waste Transport Cost. The Direct County Cost for waste transport is that cost for which Chautauqua County would be directly responsible. This Direct County Cost includes transfer station costs (if any) and the resource recovery processing plant residuals waste transport cost to a landfill. The Total Waste Transport Cost includes the Direct County costs as well as the (1) haul costs from the centroid of each municipality to the resource recovery facility or transfer station, (2) waste transport costs from the centroid of each municipality to landfills when the resource recovery facility is not operating due to breakdown or other reason, and (3) waste transport-costs from the centroid of each municipality to a landfill, of wastes that are not processable at the resource recovery facility, such as certain types of industrial noncombustible/nonprocessable wastes. Both Direct County and Total Waste Transport Costs are tabulated in Table 6-1. The waste quantity used for the analysis of the transportation schemes is 660 tons per day (1985 waste projection, Table 2-15). From the waste analysis discussion in Chapter 5, approximately 430 tons per day is receivable at the recovery facility and the remaining 230 tons per day of industrial non-combustible wastes would be disposed at a landfill. Of the 430 tons per day of waste generated, it is assumed that only 90 percent or 385 tons per day would be collected and delivered to the resource recovery facility for processing.

The following is a listing of the waste transport schemes analyzed herein:

WASTE TRANSPORT SCHEMES

Scheme Classification	Title
I	One resource recovery facility in Jamestown with transfer station in Dunkirk.

Scheme Classification	Title
II	One resource recovery facility in Dunkirk with transfer station in Jamestown.
III	Two resource recovery facilities, one in Dunkirk and one in Jamestown.
IV	One resource recovery facility in Jamestown with direct haul of all county wastes.
V	One resource recovery facility in Dunkirk with direct haul of all county wastes.
VI	Direct haul all county wastes to three existing landfills - South Stockton, Chautauqua and Dunkirk.
VII	Direct haul to proposed landfill - Arkwright and Busti.

TRANSPORTATION SCHEME ANALYSIS

This waste transportation scheme analysis includes seven alternatives, which will permit a meaningful evaluation of haul costs for various resource recovery facility alternatives and conventional landfill disposal. The existing landfill sites, South Stockton, Chautauqua and Dunkirk were included since this is the current disposal system utilized. At the time this report was being prepared, the Arkwright and Busti landfills were only being investigated as "potential" future landfill sites and may not necessarily be developed in the future. The inclusion of these two "potential" future landfill sites serves as a cost guide to expected haul costs to landfills located at these approximate locations. Developmental costs are also developed for the Busti and Arkwright landfill sites. These cost estimates are provided on very limited information supplied by the County, which necessitated various assumptions. Therefore, these costs will have to be refined in the future before they can be considered final. Cost estimates are given for the Busti and Arkwright landfill sites in Appendix E. The location of the Busti and Arkwright sites is shown in Figure 6-7. For the Busti site, at 300 tons per day, 312 days per year, the estimated current operating cost is $3.30 per ton, with a 40-year site life. For the Arkwright site at 300 tons per day, 312 days per year, the estimated current operating cost is $2.75 per ton, with a 40-year site life. For landfill disposal costs used later, it is assumed to be $4.00 per ton, since the actual future landfill sites have not been determined and costs to develop these future sites due to additional environmental or other site-specific conditions could easily raise the present day landfill costs to $4.00 per ton.

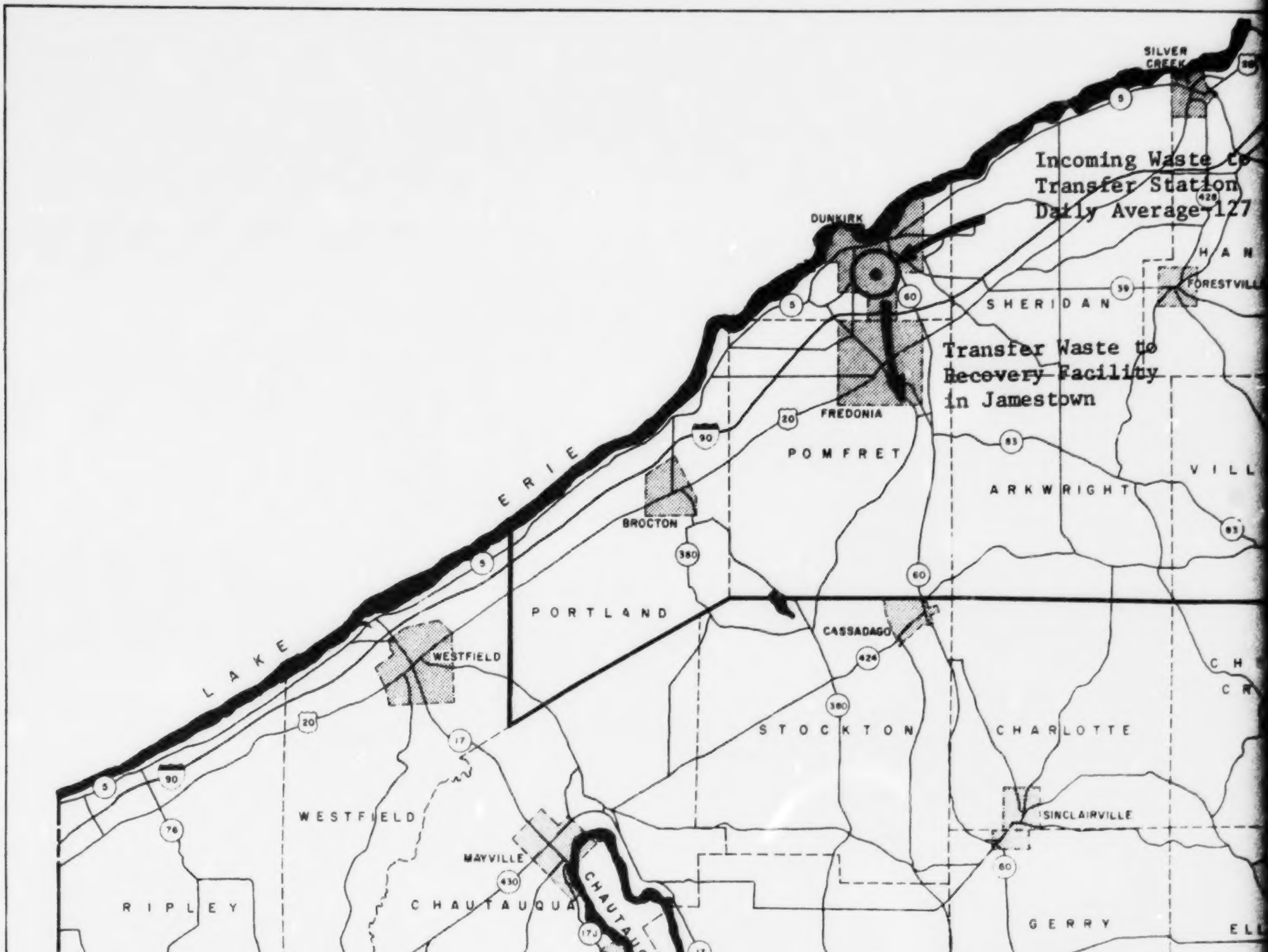
Capital and operating costs are developed for transfer stations located in Jamestown and Dunkirk. These costs are included in the appropriate waste transport scheme costs. The transfer station costs are detailed in Appendix F.

It is estimated that there will be 30 operating days each year that the recovery system will not be operating due to user outages and processing plant maintenance. Therefore, out of 312 waste generating days per year (6 days per week), the transfer station and haul cost analysis to the recovery facility is based on 282 operating days. On those days that the resource recovery system is not operating the wastes would be "direct hauled" to the closest sanitary landfill.

Following each waste transport scheme analysis is a county map showing potential locations of landfill sites, transfer stations and resource recovery facilities. These locations are not meant to be exact, but merely provide a general location so that haul costs could be developed. The relative locations of the facilities are the same so the various alternative transport schemes can be compared.

Wastes Transport Scheme I involves one resource recovery facility located in Jamestown with a transfer station in Dunkirk. Figure 6-1 indicates the communities near Dunkirk that would utilize the transfer station. The total of daily incoming wastes expected at the transfer station is 127 tons per day. This waste would be transferred to the resource recovery facility in Jamestown. All other acceptable waste in the county would then be direct hauled to the recovery facility at Jamestown, approximately 258 tons per day, for a total of 385 tons per day of processable wastes received. Annual waste transport cost for Scheme I at 282 days per year is $527,300 or $4.85 per ton. Included in the annual cost is the transfer station costs at $253,100, which translates to $7.05 per ton at 127 tons per day for the Dunkirk area. However when included with the total county haul cost it is less, i.e. $4.85 per ton. Annual residual haul cost from the Jamestown resource recovery facility to the Busti landfill is $48,800 or $2.20 per ton at 79 tons per day. The annual cost to haul the non-processable wastes is $193,000 or $2.25 per ton. This is the same for all schemes analyzed. The Annual Total Waste Transport Cost is $797,300 or $3.50 per ton. The Annual Direct County Cost is $301,900 or $2.30 per ton.

Waste Transport Scheme II is the reverse of Scheme I, with one resource recovery in Dunkirk and a transfer station in Jamestown. Figure 6-2 illustrates the communities near Jamestown that would utilize the transfer station facility. The Jamestown transfer station would receive a daily average waste load of 211 tons. The remaining 174 tons of the northern communities, as designated in Figure 6-2, would direct haul their wastes to the resource recovery facility in Dunkirk. The annual waste transport cost for scheme II at 282 days per year is $614,800 or $5.65 per ton. Annual transfer station cost, included in the $614,800 is $359,000, or $6.00 per ton at 211 tons per day for the Jamestown area. Annual residual haul cost from the Dunkirk resource recovery facility to the Arkwright landfill is $51,400 or $2.30 per ton at 79 tons per day. Thus the Annual Total Waste Transport Cost is $887,400 or $3.90 per ton and the Annual Direct County Cost is $410,400 or $3.15 per ton.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SINCLAIRVILLE
BEMUS POINT
CELORON
LAKEWOOD
JAMESTOWN
FALCONER
SHERMAN
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FORESTVILLE
HAN
SHERIDAN
POMFRET
ARKWRIGHT
VILL
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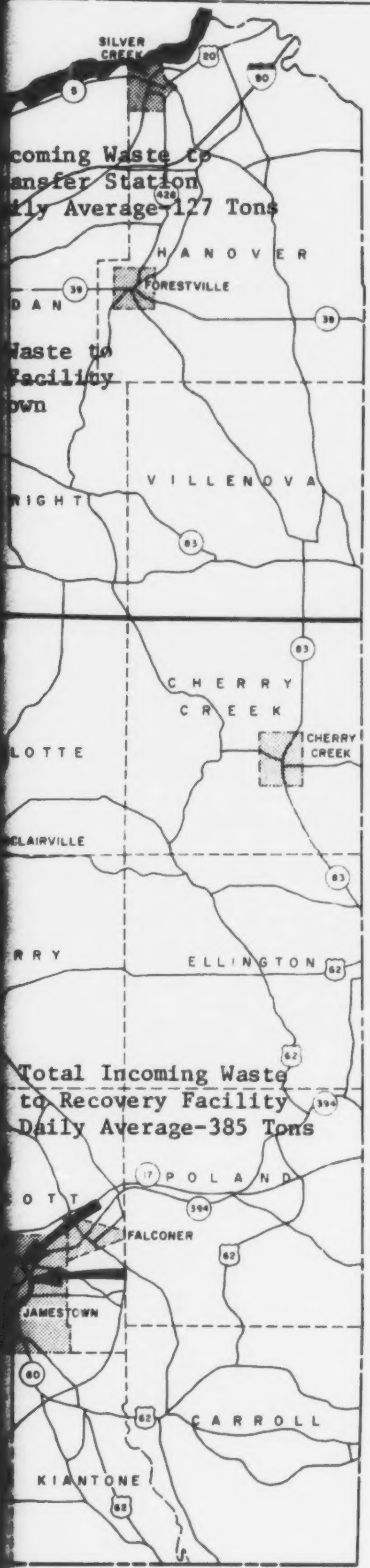
Incoming Waste t
Transfer Station
Daily Average-127

Transfer Waste to
Recovery Facility
in Jamestown

Total Incoming
to Recovery Fac
Daily Average-3

Daily Residue of
79 Tons from Recovery
Facility to Landfill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JAMESTOWN
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CARROLL
KIANTONE
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SCALE IN MILES

coming Waste to
ansfer Station
ily Average-127 Tons

Waste to
Facility
own

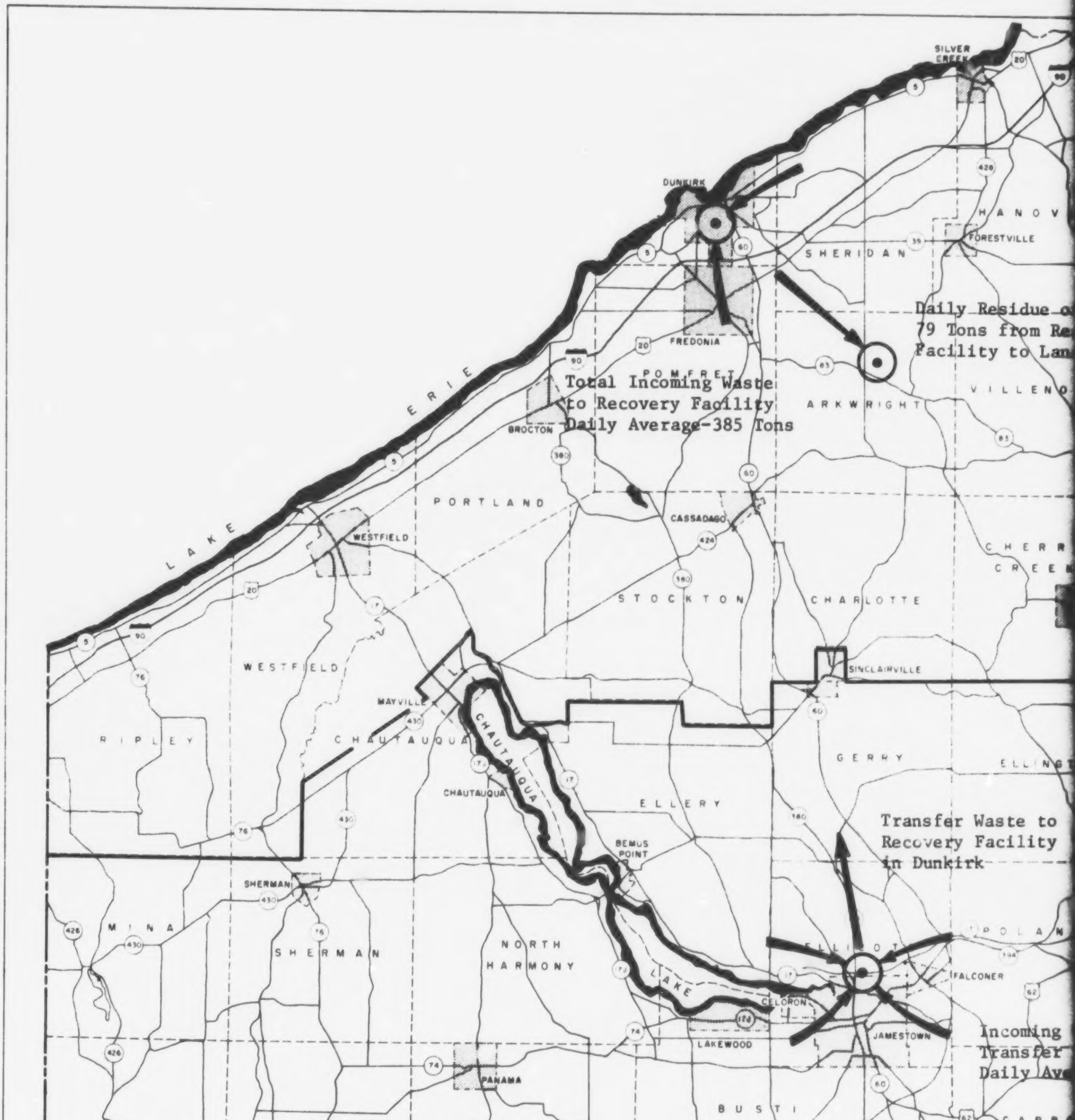
Total Incoming Waste
to Recovery Facility
Daily Average-385 Tons

FIGURE 6-1

WASTE TRANSPORT SCHEME I

ONE RESOURCE RECOVERY FACILITY
IN JAMESTOWN WITH TRANSFER
STATION IN DUNKIRK

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK
GILBERT ASSOCIATES, INC.
Reading, Pa.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RIPLEY
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CHAUTAUQUA
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FALCONER
CELORON
LAKEWOOD
JAMESTOWN
PANAMA
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CLYMER
HARMONY
FRENCH CREEK
KIANTONE
CARRO
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380
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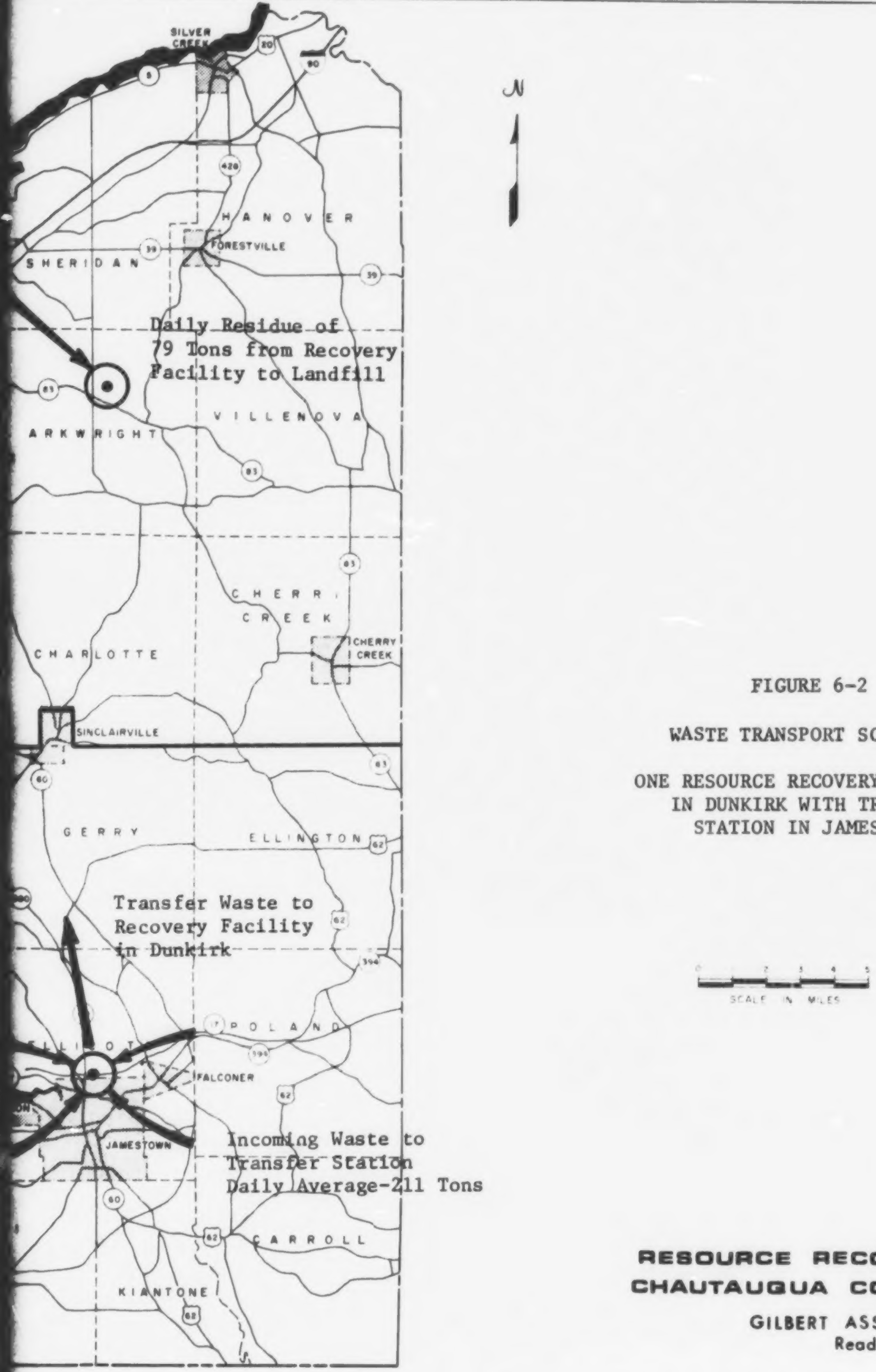
76
430
394
62
426
74

Total Incoming Waste to Recovery Facility Daily Average-385 Tons

Daily Residue o
79 Tons from Re
Facility to Lan

Transfer Waste to Recovery Facility in Dunkirk

Incoming
Transfer
Daily Ave


SILVER CREEK
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CHERRY CREEK
CHERRY CREEK
CHARLOTTE
SINCLAIRVILLE
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GERRY
ELLINGTON
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POLAND
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FALCONER
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JAMESTOWN
60
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CARROLL
KIANTONE
62
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0 1 2 3 4 5
SCALE IN MILES

Daily Residue of 79 Tons from Recovery Facility to Landfill

Transfer Waste to Recovery Facility in Dunkirk

Incoming Waste to Transfer Station Daily Average-211 Tons

FIGURE 6-2

WASTE TRANSPORT SCHEME II

ONE RESOURCE RECOVERY FACILITY
IN DUNKIRK WITH TRANSFER
STATION IN JAMESTOWN

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK

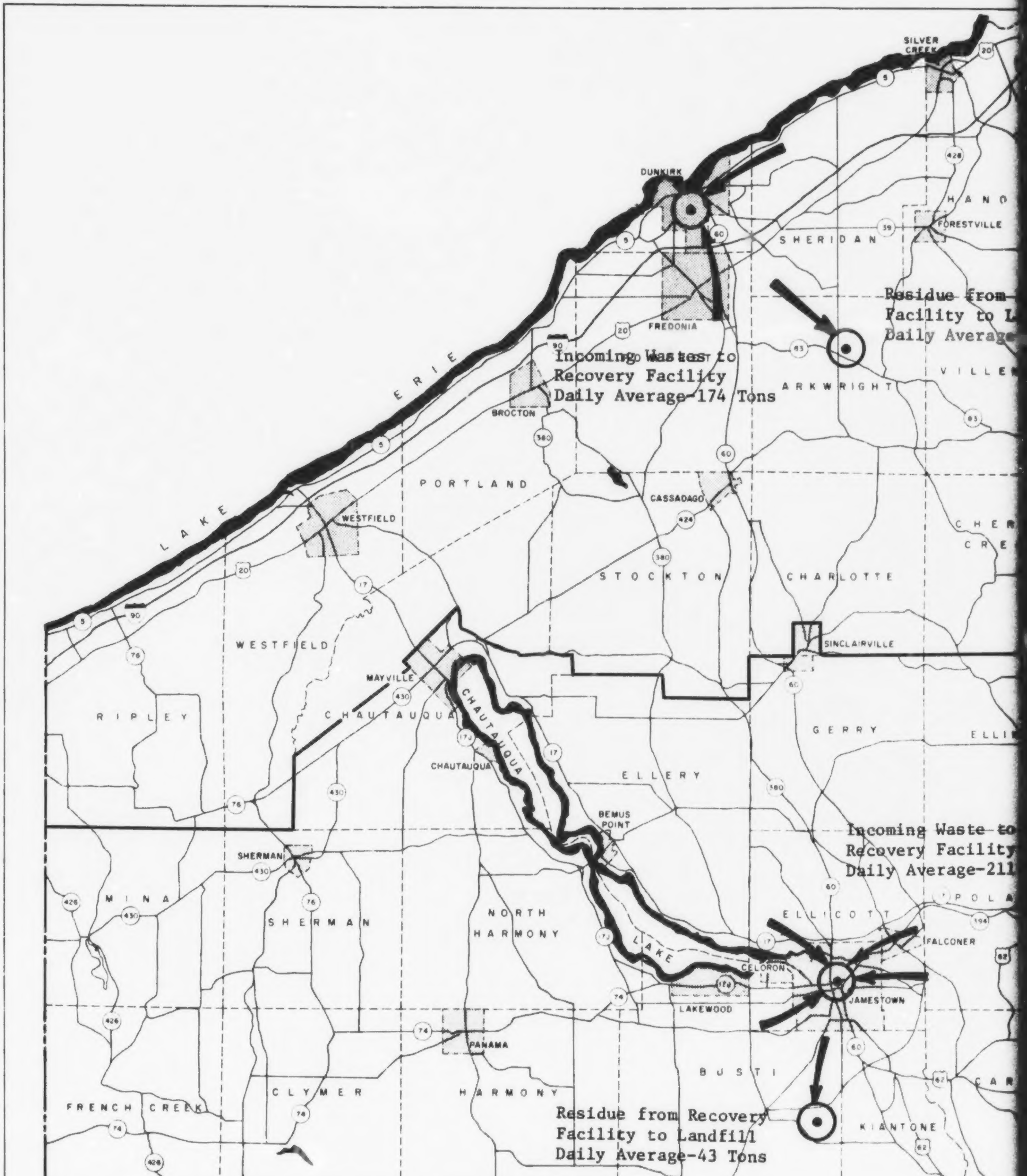
GILBERT ASSOCIATES, INC.
Reading, Pa.

Waste Transport Scheme III includes two resource recovery facilities, one in Jamestown and one in Dunkirk. Wastes would be hauled directly to the facilities as illustrated in Figure 6-3. The total incoming waste load at Dunkirk is expected to be 174 tons per day, with up to 36 tons per day of residual from the recovery facility to be hauled to the Arkwright landfill. Total incoming wastes anticipated at Jamestown is 211 tons per day, with up to 43 tons per day of residual to be hauled to the Busti landfill. The total annual waste transport cost for Scheme III at 282 days per year is $281,600 or $2.60 per ton. Estimated annual residual haul cost for Dunkirk and Jamestown is $85,900 or $3.85 per ton. The Annual Total Waste Transport Cost is $588,700 or $2.60 per ton. The Direct County Annual Cost is $85,900, or $3.85 which is for residual disposal from the recovery facility. There are no other county-related waste transport costs.

Waste Transport Scheme IV involves one resource recovery facility located in Jamestown, with direct haul of all acceptable wastes in the county to the facility. Figure 6-4 illustrates the waste flow quantities. It is expected that 385 tons per day of wastes would be delivered by direct haul to the processing facility, and approximately 79 tons per day of residual would be hauled to the Busti landfill. The annual waste transport cost for Scheme IV at 282 days per year is $532,900 or $4.90 per ton. The anticipated annual residual haul cost to the Busti landfill at 79 tons per day is $48,800 or $2.20 per ton. The Annual Total Waste Transport Cost is $802,900 or $3.50 per ton. The Direct County Waste Transport Cost is $48,800 or $2.20 per ton, which is for processing plant residual disposal. Since there are no transfer station costs in this scheme, there are no other county-related costs.

Waste Transport Scheme V is the reverse of Scheme IV, involving one resource recovery facility located in Dunkirk with direct haul of all acceptable county wastes to the facility. Figure 6-5 illustrates waste flow patterns. It is anticipated that 385 tons per day of wastes would be delivered by direct haul to the processing facility and approximately 79 tons per day of residual from the recovery facility would be hauled to the Arkwright landfill. The annual waste transport cost for Scheme V at 282 days per year is $608,900 or $5.60 per ton. The anticipated annual residual haul cost to the Arkwright landfill at 79 tons per day is $51,400 or $2.30 per ton. The Annual Total Waste Transport Cost is $881,500 or $3.90 per ton. The Direct County Waste Transport Cost is $51,400 or $2.30 per ton, which is for processing plant residual disposal. There are no other county-related costs in this Scheme.

Waste Transport Scheme VI involves the direct haul of all wastes (660 tons per day) to the three existing county landfill sites currently used, namely Dunkirk, South Stockton, and Chautauqua. The following municipal breakdown was used to analyze the haul costs: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DUNKIRK
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FREDONIA
VILLEN
ARKWRIGHT
BROCTON
PORTLAND
CASSADAGO
LAKE ERIE
WESTFIELD
CHER
CRE
STOCKTON
CHARLOTTE
SINCLAIRVILLE
MAYVILLE
RIPLEY
CHAUTAUQUA
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NORTH HARMONY
ELLICOTT
POLA
FALCONER
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JAMESTOWN
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CHAUTAUQUA LAKE
BUSTI
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CLYMER
HARMONY
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430
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17B

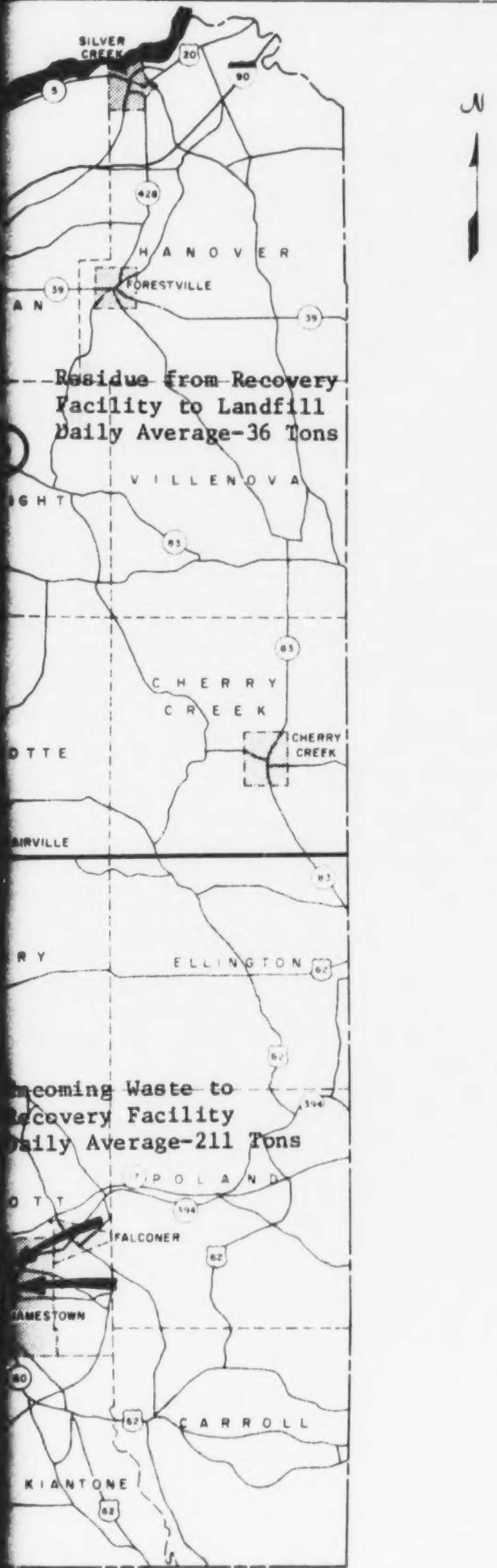
Incoming Wastes to
Recovery Facility
Daily Average-174 Tons

Residue from
Facility to L
Daily Average

Incoming Waste to
Recovery Facility
Daily Average-211

Residue from Recovery
Facility to Landfill
Daily Average-43 Tons

6.4a


SILVER CREEK
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428
HANOVER
FORESTVILLE
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AN
Residue from Recovery Facility to Landfill Daily Average-36 Tons
VILLENOVA
GHT
83
CHERRY CREEK
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OTTE
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62
Incoming Waste to Recovery Facility Daily Average-211 Tons
394
POLAND
FALCONER
JAMESTOWN
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CARROLL
KIANTONE
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0 1 2 3 4 5
SCALE IN MILES

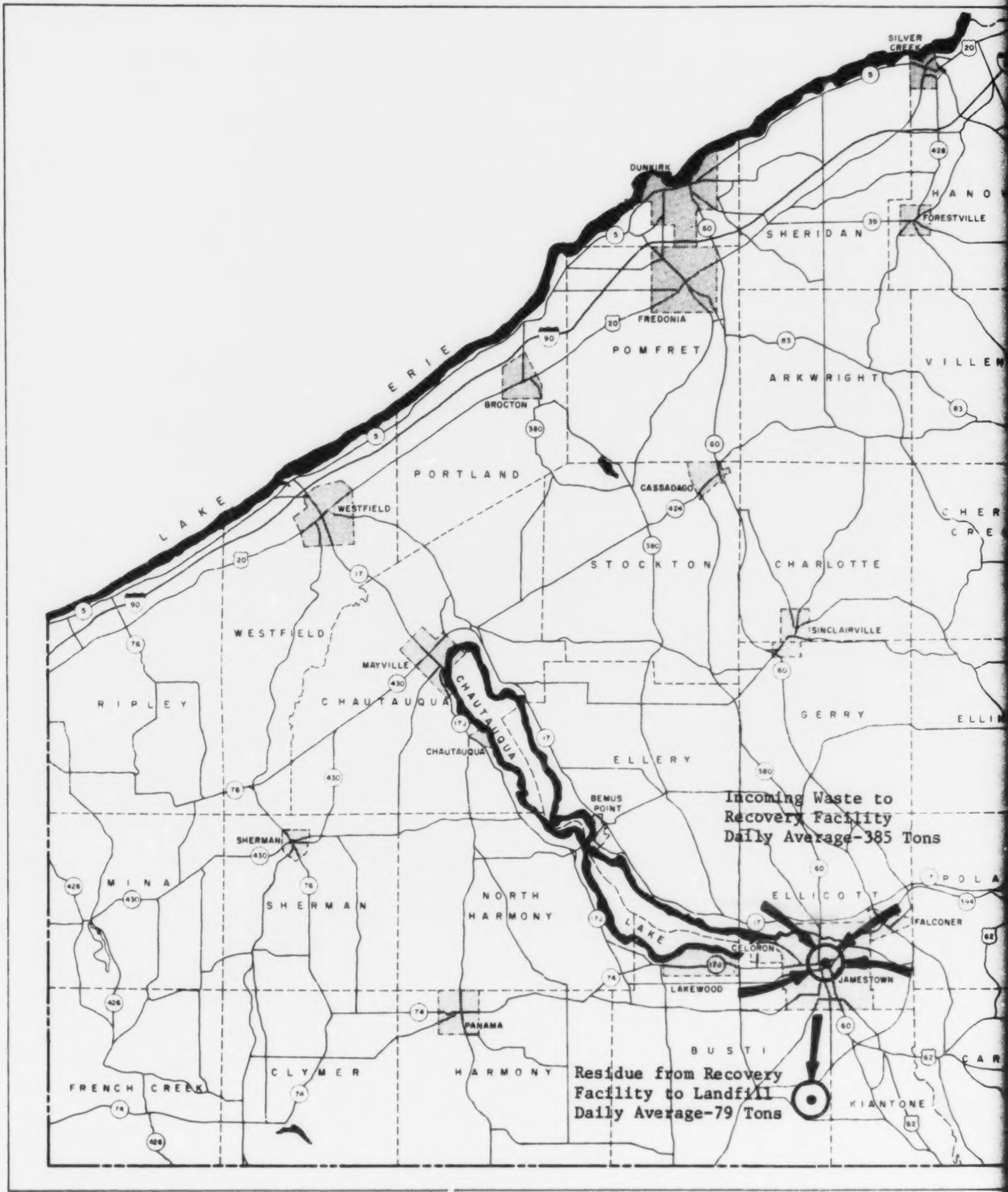
FIGURE 6-3

WASTE TRANSPORT SCHEME III

RESOURCE RECOVERY FACILITIES
IN DUNKIRK & JAMESTOWN WITH
DIRECT HAUL TO EACH FACILITY

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK

GILBERT ASSOCIATES, INC.
Reading, Pa.



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BROCTON
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CASSADAGA
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BEMUS POINT
SHERMAN
CELORON
LAKEWOOD
JAMESTOWN
FALCONER
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POMFRET
ARKWRIGHT
VILLEN
PORTLAND
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FRENCH CREEK
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20
90
60
39
426
83
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424
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430
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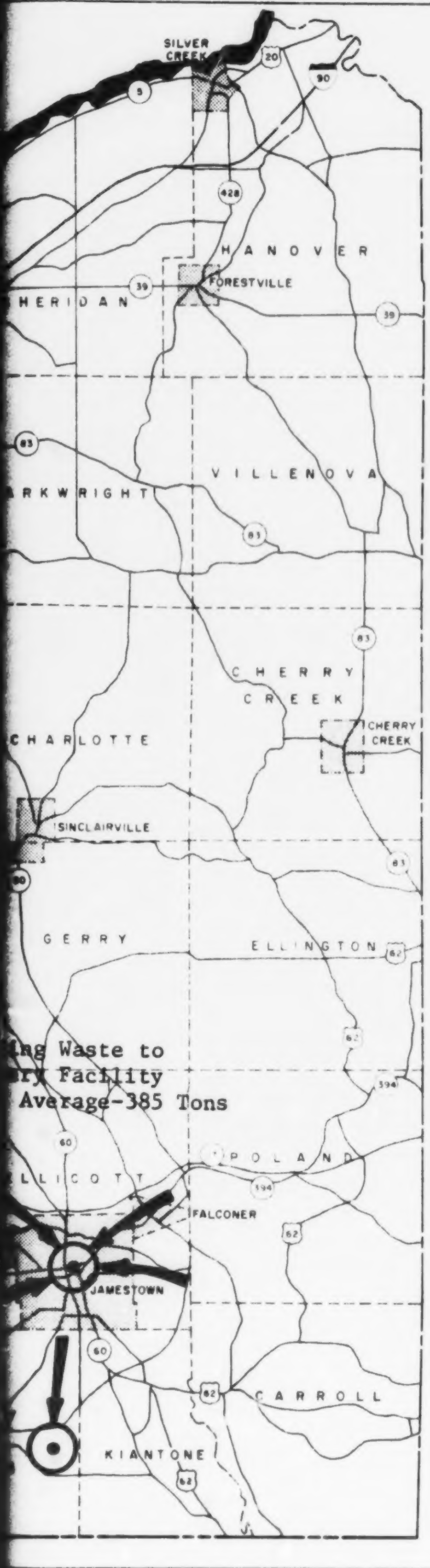
62
74

Incoming Waste to Recovery Facility Daily Average-385 Tons

Residue from Recovery Facility to Landfill Daily Average-79 Tons

6,4 2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CHARLOTTE
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ery Facility
Average-385 Tons
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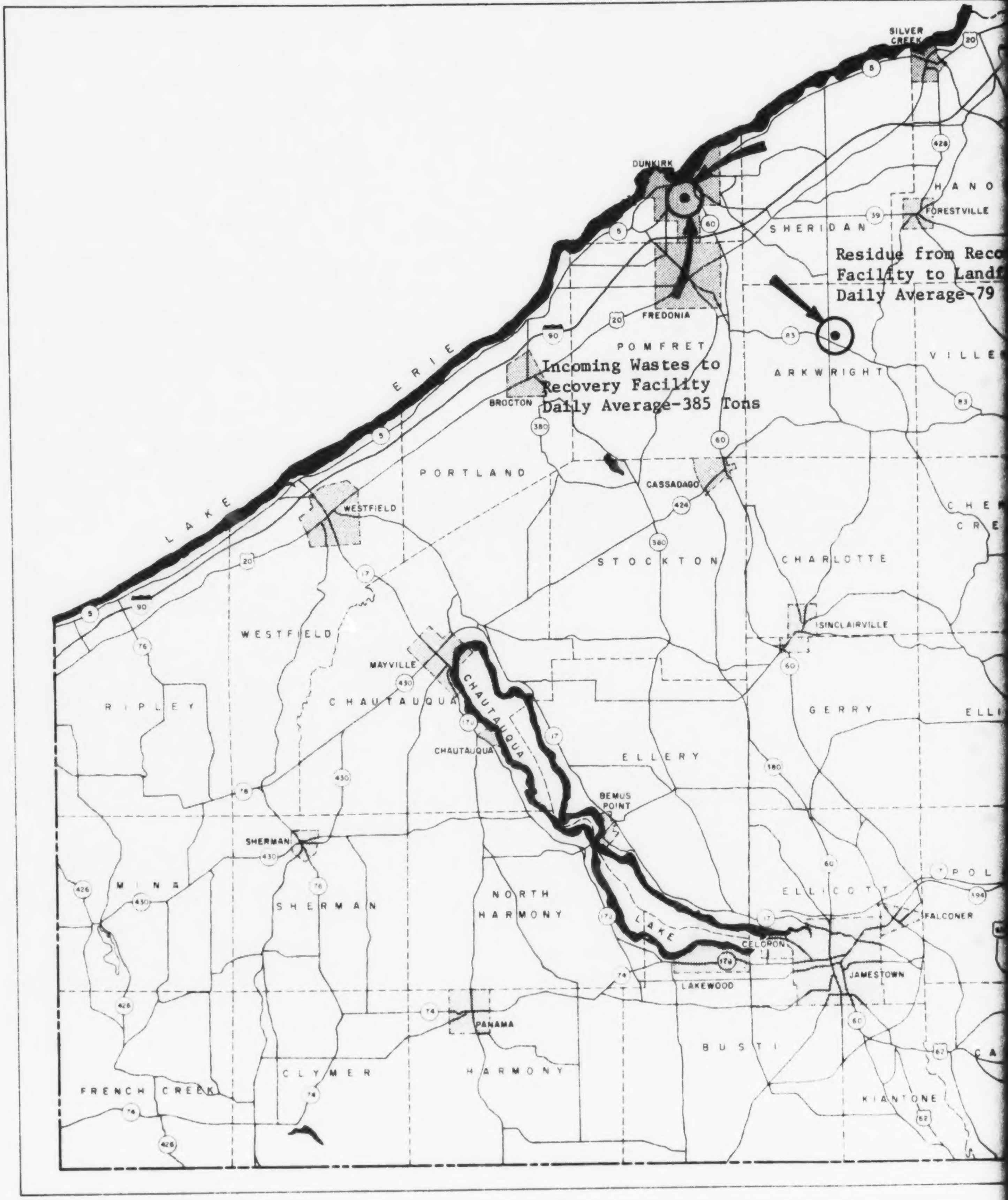
FALCONER
JAMESTOWN
CARROLL
KIANTONE
N
SCALE IN MILES

FIGURE 6-4

WASTE TRANSPORT SCHEME IV

ONE RESOURCE RECOVERY FACILITY
IN JAMESTOWN
WITH DIRECT HAUL

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK
GILBERT ASSOCIATES, INC.
Reading, Pa.



Incoming Wastes to Recovery Facility Daily Average-385 Tons

Residue from Reco
Facility to Landf
Daily Average-79

LAKE ERIE
SILVER CREEK
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FORESTVILLE
HANO
SHERIDAN
POMFRET
ARKWRIGHT
VILLEN
BROCTON
PORTLAND
CASSADAGO
WESTFIELD
STOCKTON
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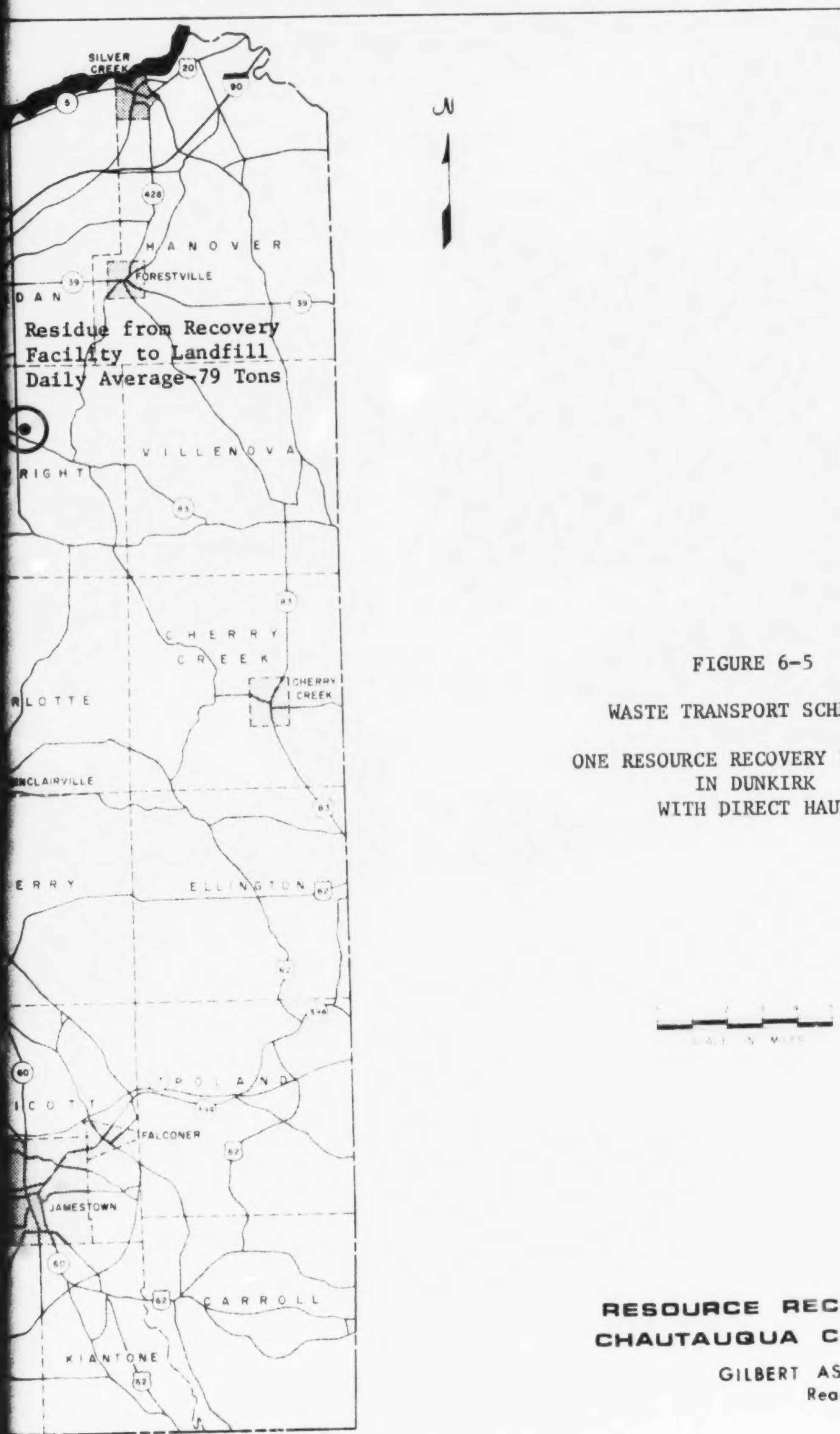
FRENCH CREEK
KIANTONE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394
POLAND
ICOTT
60
FALCONER
JAMESTOWN
CARROLL
KIANTONE
SCALE IN MILES

Residue from Recovery
Facility to Landfill
Daily Average-79 Tons

FIGURE 6-5

WASTE TRANSPORT SCHEME V

ONE RESOURCE RECOVERY FACILITY
IN DUNKIRK
WITH DIRECT HAUL

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK

GILBERT ASSOCIATES, INC.
Reading, Pa.

Dunkirk Landfill Serves:

- Arkwright
- Dunkirk (City & Town)
- Hanover
- Pomfret
- Portland
- Sheridan
- Villanova

South Stockton Landfill Serves:

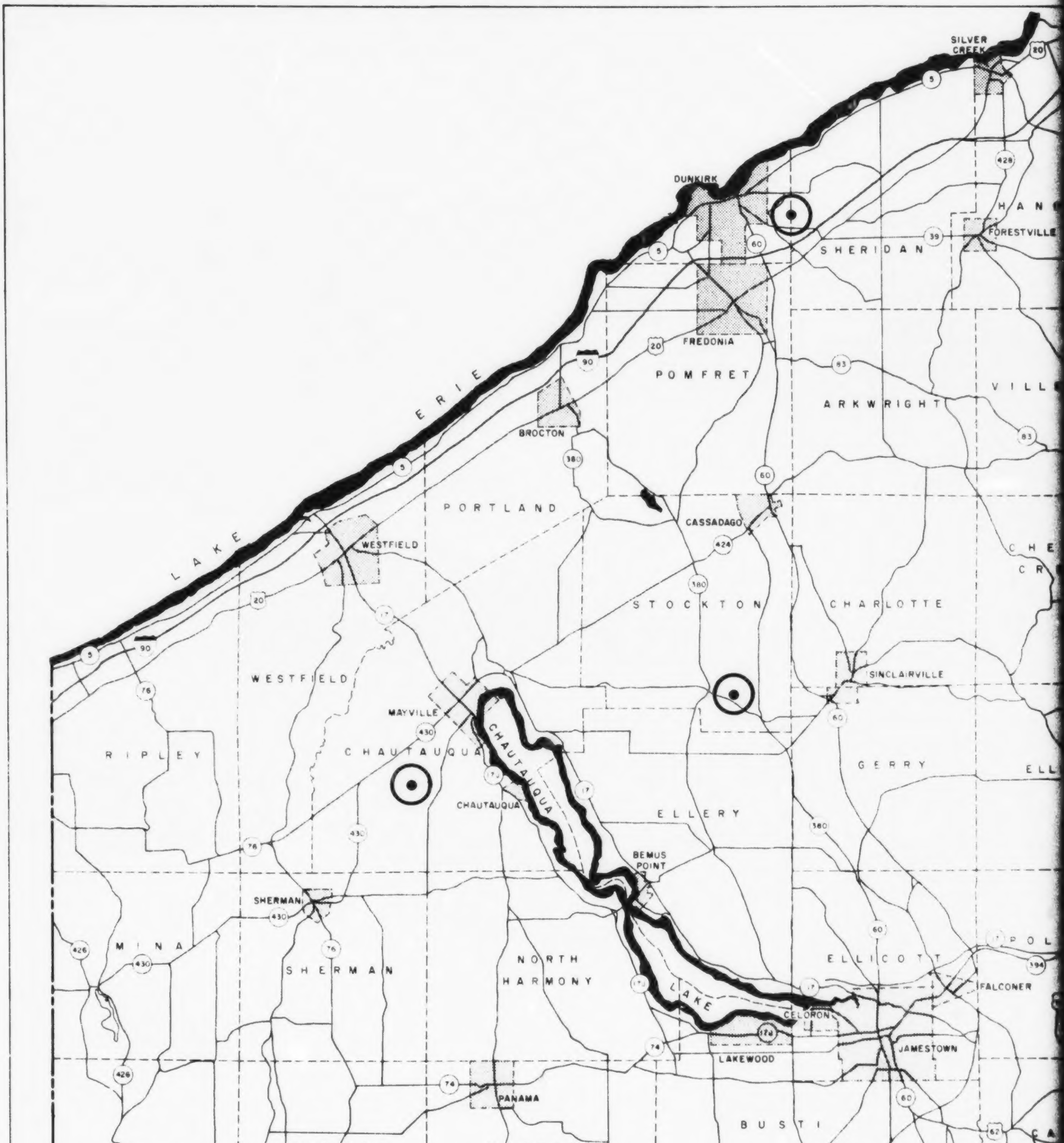
- Busti
- Carroll
- Charlotte
- Cherry Creek
- Ellery
- Ellicott
- Ellington
- Gerry
- Kiantone
- Poland
- Stockton
- Jamestown

Chautauqua Landfill Serves:

- Chautauqua (North)
- Chautauqua (South)
- Clymer
- French Creek
- Harmony
- Mina
- North Harmony
- Ripley
- Sherman
- Westfield

Figure 6-6 illustrates the existing landfill locations. Since the landfills will be operating 312 days per year (6 days per week) there will be no need to include a 30-day contingency disposal alternative as is required for waste transport Schemes I-V. (This will be discussed later.) Also, since all wastes are being hauled to the landfill sites, 660 tons per day, (not 385 tons per day), there will be no need to include a haul cost for the industrial non-combustible wastes not brought to a resource recovery facility, but hauled to a landfill. The annual waste transport cost for Scheme VI at 312 days per year is $498,200 or $2.40 per ton.

Waste Transport Scheme VII is similar to Scheme VI, differing only in using future proposed landfill sites instead of existing landfill sites. Figure 6-7 illustrates the general locations of the proposed future Arkwright and Busti landfill sites, as well as the expected daily waste load and communities designated to utilize each site. Since the total 1985 waste load of 660 tons per day for Chautauqua County is being considered, the same discussion given in Scheme VI concerning contingency landfill needs and haul costs for non-combustible industrial waste holds true for this scheme. The annual waste transport cost for scheme VII at 312 days per year is $537,300 or $2.60 per ton. It is interesting to note that even by locating both proposed landfills in the eastern section of the county as opposed to having three landfills as in Scheme VI, (where one - the Chautauqua landfill - was located in the west-central area), the total effect on the haul cost for the entire county was only $0.20 per ton higher for the two landfills versus three. The reason for this is that most of the waste is generated in the Dunkirk and Jamestown areas. The western communities of Chautauqua County have a very low waste generation. As a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WESTFIELD
STOCKTON
CHARLOTTE
SINCLAIRVILLE
WESTFIELD
MAYVILLE
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NORTH HARMONY
ELLICOTT
FALCONER
LAKE
CELORON
LAKEWOOD
JAMESTOWN
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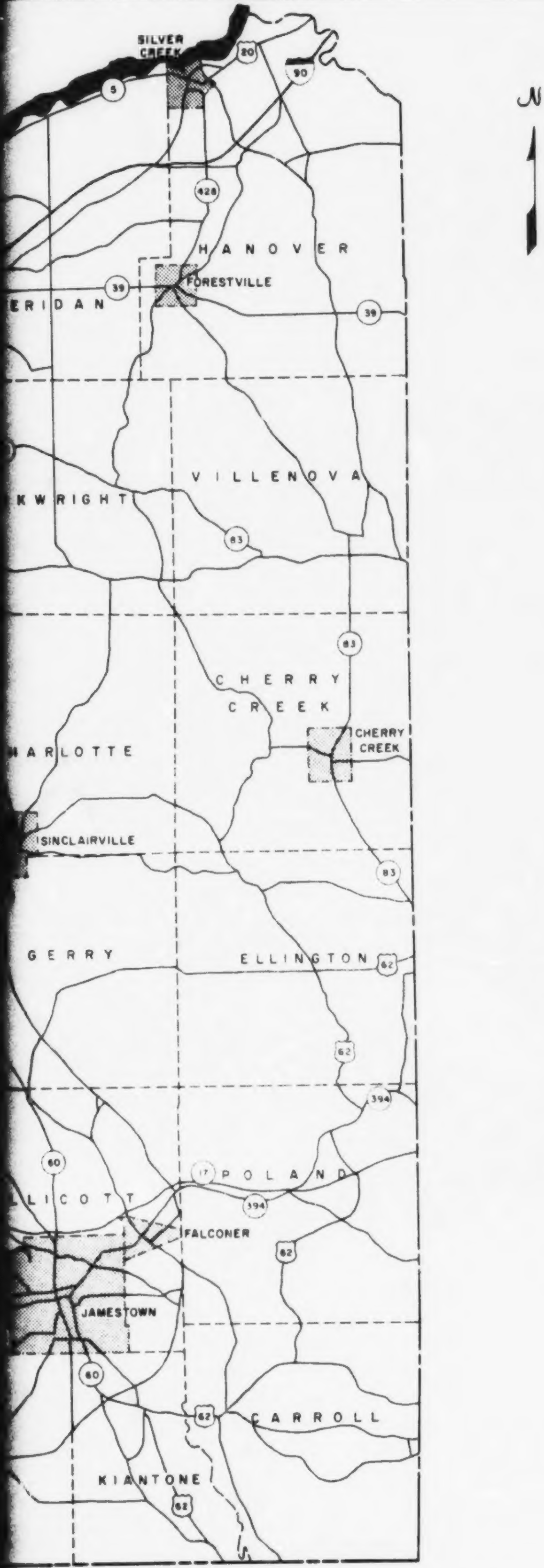
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JAMESTOWN
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62
CARROLL
KIANTONE
62

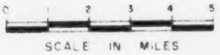
FIGURE 6-6

WASTE TRANSPORT SCHEME VI

DIRECT HAUL TO THE THREE MAJOR
EXISTING COUNTY LANDFILLS

LEGEND

⊙ - LANDFILL SITE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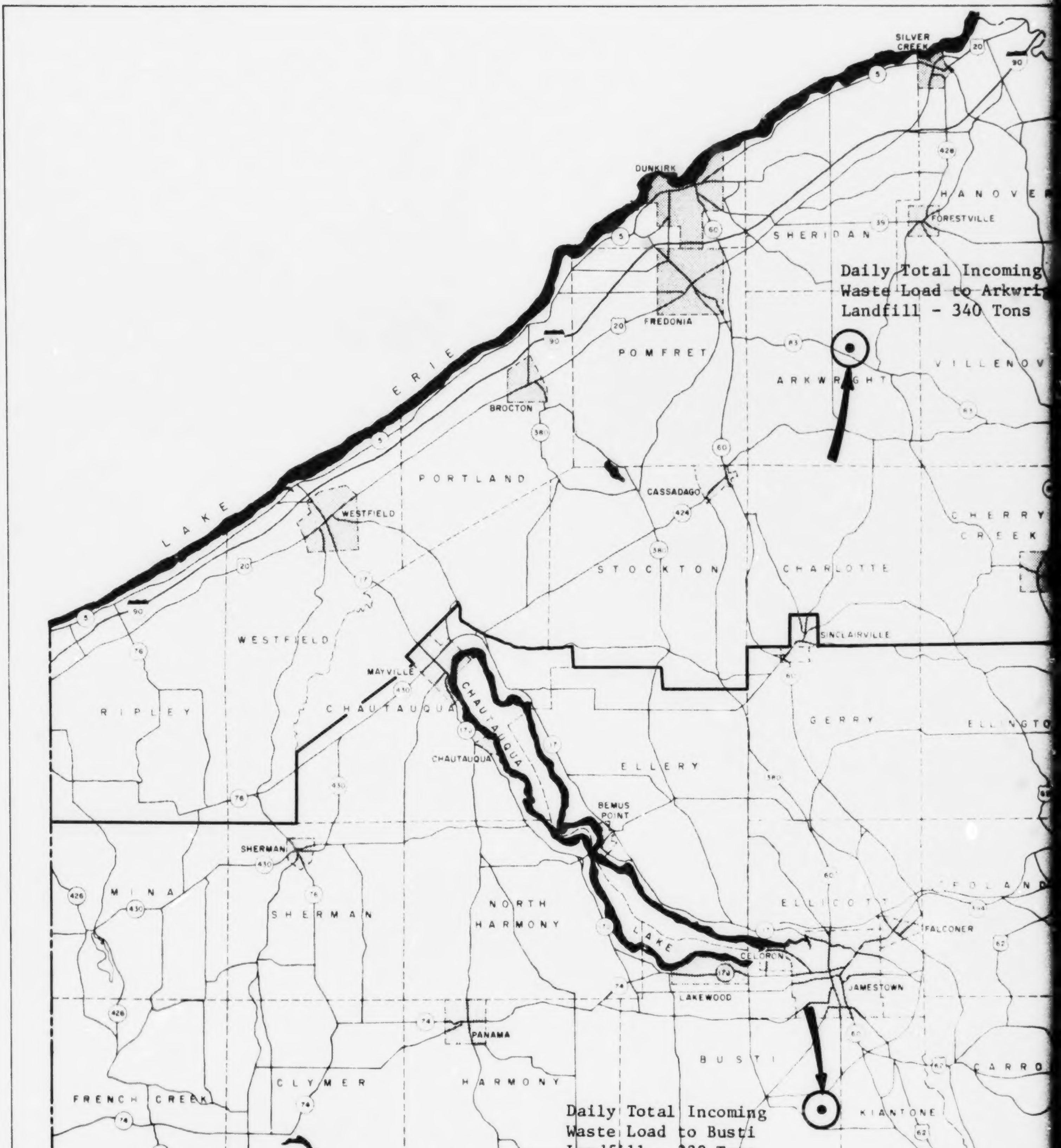
SCALE IN MILES

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK
GILBERT ASSOCIATES, INC.
Reading, Pa.



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CASSADAGO
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NORTH HARMONY
ELLICOTT
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FRENCH CREEK
KIANTONE
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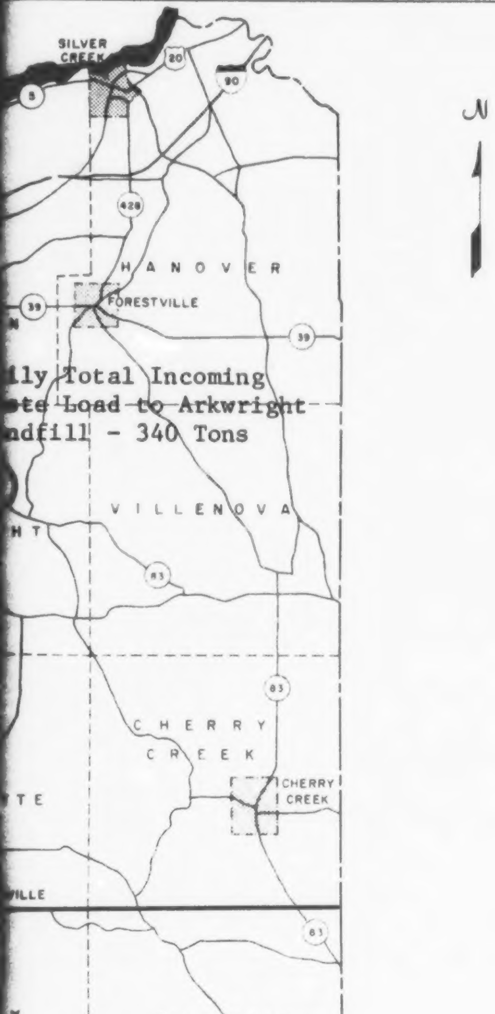
Daily Total Incoming
Waste Load to Arkwri
Landfill - 340 Tons

Daily Total Incoming
Waste Load to Busti
Landfill - 320 Tons

6.5a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39
39
ily Total Incoming
ste Load to Arkwright
ndfill - 340 Tons
VILLENOVA
HT
83
83
CHERRY CREEK
CHERRY CREEK
TE
VILLE
83
Y
ELLINGTON
62
62
394
POLAND
394
FALCONER
62
STOWN
62
CARROLL
IANTONE
62

FIGURE 6-7

WASTE TRANSPORT SCHEME VII

DIRECT HAUL TO
PROPOSED LANDFILLS

LEGEND

⊙ - LANDFILL SITE

0
1
2
3
4
5
SCALE IN MILES

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK

GILBERT ASSOCIATES, INC.
Reading, Pa.

result, it appears desirable, to keep county landfill developmental costs down, that future landfill sites should be located in the areas of Chautauqua County closest to the two major cities. This would also facilitate the disposal of residual from a resource recovery facility constructed in either city. Haul costs to these sites from the western county areas will be higher for these residents; but, as indicated previously, the low waste generation from western Chautauqua County results in a higher County Direct Cost in maintaining three versus two landfills, with only modest county wide increases in haul costs for the two landfills scheme.

LANDFILL HAUL COST DURING OUTAGE PERIODS OF PRODUCER/USER FACILITIES

During each year it is estimated that 30 normal operating days will be lost at a resource recovery facility due to necessary repairs or maintenance, as well as fuel user outage for facility maintenance, inspection, etc. As a result the wastes normally brought to the resource recovery facility or transfer station would be diverted to the closest landfill site. For analysis, the Busti and Arkwright landfill sites are used. Referring to Figure 6-7, waste allocation would most probably follow the indicated municipal division to the respective landfill sites. During these 30 days, the estimated waste load to the Arkwright site would be 174 tons per day that would normally go to the recovery facility or transfer station, plus the non-combustible industrial wastes and the fraction of wastes undeliverable to the recovery facility. The same is true for the Busti site, in that the expected waste load would be 211 tons per day plus non-combustible industrial and the undeliverable fractions, as previously described. The total county landfill waste load would be 660 tons per day.

Of importance is the cost to direct haul the 174 and 211 tons per day to the respective Arkwright and Busti landfill sites. Therefore, only the haul cost associated with direct haul of 385 tons per day of waste usually going to the recovery facility will be given here. The remaining haul costs will be discussed in the next section. Thus, the total annual cost to direct haul the wastes to the Arkwright and Busti landfills is $28,200 per year at 30 days per year, or $2.45 per ton. This cost is not a Direct County cost, but a user cost.

HAUL COST FOR INDUSTRIAL NON-COMBUSTIBLE WASTES

When the haul costs for wastes to a resource recovery facility were considered, industrial non-combustible waste haul costs were not included as also were not the haul costs for the non-deliverable fraction of the municipal waste load.(a) To determine this haul cost, it is assumed that this waste material (275 tons per day) would go to the closest landfill site for disposal. The Arkwright and Busti landfill sites are used as the disposal sites. The industrial waste load allocation to the respective landfill sites is similar to Figure 6-7. Therefore the total annual haul cost for the industrial non-combustible wastes to a landfill at 312 days per year and 275 tons per day is $193,000 or $2.25 per ton. This cost is not a Direct County cost but a user cost.

(a) 660 tons per day 1985 county generation rate; 385 tons per day to recovery facility; 660 - 385 = 275 tons per day to be landfilled.

SUMMARY OF ALTERNATIVE WASTE TRANSPORT SCHEMES

A summary of the haul costs associated with the various alternative waste transport schemes is given in Table 6-1. Annual costs as well as the associated tonnages for wastes hauled are provided. Waste transport costs per ton are developed from the annual tonnage of 228,198 tons per year, except for the "landfill-only" schemes, which have an annual tonnage of 205,920 tons per year. The reason for the difference is that there are no recovery plant residue tonnages associated with the landfill-only alternative.

With one resource recovery facility in Jamestown Scheme I, there appears to be an overall waste transport savings of approximately 2 percent, using a transfer station for the Dunkirk Area versus direct haul of wastes to the resource recovery facility in Jamestown from the entire county under Total Waste Transport Costs. Also considering one resource recovery facility in Dunkirk, Scheme II, the waste transport cost is approximately equal to the direct haul cost. The reason for the lack of major benefit from a transfer station in this case is that an insufficient quantity of wastes is available at each transfer station to maximize its effectiveness, when compared to direct hauling wastes to the same location. If a very large concentration of waste had to be hauled a short distance to the transfer station, then the total transfer station costs would be much less than the direct haul cost. However, in these cases, some wastes must be hauled considerable distances to the transfer station, whereas if they are direct hauled to the ultimate destination, the incremental cost increase is not significant. What is not illustrated in the costs of transfer stations versus direct haul is the time saved by those collecting wastes. Although it is assumed that all wastes allocated to a transfer station or direct-haul recovery plant are delivered in one day, it most probably will take longer to deliver the wastes by direct haul than by the use of a transfer station. Thus the transfer station results in a faster return to the collection area for the local waste collection vehicles.

The Direct County Cost for Scheme I with a transfer station in Dunkirk, versus Scheme II, with a transfer station in Jamestown, results in an estimated $108,500 higher cost or 26% increase in Direct County Cost for Scheme II versus Scheme I. The reason is that for a transfer station in Jamestown much more waste (211 tons per day) would have to be hauled to Dunkirk, whereas for the transfer station in Dunkirk only 127 tons per day would be transferred to Jamestown. Therefore the increased costs are due to a larger volume of waste to be handled and transported.

Direct haul costs to two resource recovery facilities are expectedly lower (for Total Waste Transport Costs) than one recovery facility, since the two plants would be located close to the two main centers of waste generation for Chautauqua County, Jamestown and Dunkirk. The Direct County Cost will be greater than for one processing facility (Schemes IV & V), because residue must be transported from two resource recovery facilities rather than one, and duplication of equipment and manpower is necessary.

TABLE 6-1

WASTE TRANSPORT SCHEME ESTIMATED
CHAUTAUQUA COUNTY,
1976

		Cost to transport waste to Resource Recovery Plant(s) (282 DPY @ 385 1 TPD = 108,570 TPY)			Cost to transport residue from Resource Recovery Plants to landfill (282 DPY @ 79 TPD = 22,278 TPY)	Cost haul landfil day RDF User DPY @ 11,5
		Transfer Station Associated Costs	Private/Municipal Haul Costs	Total Waste Transport Costs to Recovery Plants		
I	One Resource Recovery Facility in Jamestown with transfer station in Dunkirk. Recovery Plant residue to assumed landfill in Busti	$253,100	$ 273,800 =	$ 527,300	$ 48,800	$ 28,
II	One Resource Recovery Facility in Dunkirk with transfer station in Jamestown. Recovery Plant residue to assumed landfill at Arkwright	$359,000	$ 255,800 =	$ 614,800	$ 51,400	$ 28,
III	Two Resource Recovery Facilities; one each in Jamestown and Dunkirk. Direct Haul of waste to each facility. Recovery Plant residue to both assumed landfills.	-	$ 281,600 =	$ 281,600	$ 85,900	$ 28,
IV	One Resource Recovery Facility in Jamestown with Direct Haul from entire County. Recovery Plant residue to assumed Busti landfill	-	$ 532,900 =	$ 532,900	$ 48,800	$ 28,
V	One Resource Recovery Facility in Dunkirk with Direct Haul from entire County. Recovery Plant residue to assumed Arkwright landfill	-	$ 608,900 =	$ 608,900	$ 51,400	$ 28,
VI	Direct haul of all County wastes to existing landfills: South Stockton, Dunkirk, and Chautauqua	-	-	-	-	
VII	Direct haul of all County wastes to Proposed Landfills: Busti and Arkwright	-	-	-	-	

(1) DPY - Days per year; TPD - tons per day; TPY - tons per year

(2) Includes all County wastes to landfill: 660 TPD @ 312 DPY = 205,920 TPY.

(3) Tonnage used to determine cost per ton is 22,278 per year; residual tonnage from processing plant.

(4) Costs that would be the responsibility of the County.

TABLE 6-1

ESTIMATED ANNUAL COST SUMMARY
COUNTY, NEW YORK
1976

Cost to direct haul waste to landfill during 30 day RDF Producer/User outage (30 DPY @ 385 TPD = 11,550 TPY	Cost to transport non-processable wastes to landfill (312 DPY @ 275 TPD = 85,800 TPY)	Total Cost to transport wastes including transfer station and haul costs @ 228,198 TPY		Direct County (4) waste transport costs for only transfer stations and Recovery Facility Residuals Costs @ 108,570 + 22,278 = 130,848 TPY	
		Annual	Cost per Ton	Annual	Cost per Ton
$ 28,200	$193,000	$797,300	$ 3.50	$301,900	$2.30
$ 28,200	$193,000	$887,400	$3.90	$410,400	$3.15
$ 28,200	$193,000	$588,700	$2.60	$ 85,900	$3.85 (3)
$ 28,200	$193,000	$802,900	$3.50	$ 48,800	$2.20 (3)
$ 28,200	$193,000	$881,500	$3.90	$ 51,400	$2.30 (3)
-	$498,200(2)	$498,200(2)	$2.40(2)	0	0
-	$537,200(2)	$537,200(2)	$2.60(2)	0	0

The direct haul cost to two or more landfills only in Chautauqua County will remain relatively low if the landfills are located near the major waste generating areas.

SUMMARY OF ALTERNATIVE WASTE TRANSPORT SYSTEMS AND RESOURCE RECOVERY FACILITY COSTS

Table 6-2 provides a summary of all waste transport schemes and the respective annual costs for:

(A) Amortizing and Operating a Solid-RDF, Gas-RDF Resource Recovery Facility or Landfill. These costs are taken from data developed in Table 5-7 for resource recovery facilities, and Appendix E, for Arkwright and Busti landfill site operating costs. Acquisition, development and operating costs of the existing landfills are not known. This cost is a Direct County Cost.

(B) Cost to Landfill Wastes Not Accepted At the Resource Recovery Facility

The estimated cost of disposal at the Busti and Arkwright landfills is $4.00 per ton. Therefore the wastes not accepted at the resource recovery facility are principally the noncombustible industrial wastes and some municipal wastes, in the case of the gas-RDF facility. The annual tonnage not accepted at a solid-RDF facility is 85,800 tons and the tonnage not accepted at a gas-RDF facility is 96,720 tons. This is a Direct County Cost since Chautauqua County would still operate landfills.

(C) Estimated Total Waste Transport Costs

These costs are developed in Table 6-1.

(D) Estimated Landfill Cost Savings by Utilizing Wastes As Energy Instead of Landfilling

Since a certain quantity of wastes are not landfilled, there is a savings at the landfill site to the county, because of lower operating costs and the conservation of available landfill space. If the landfill costs are estimated at $4.00 per ton for disposal, it is assumed that $1.00 per ton is "saved" or "credited" to each ton not landfilled, but utilized as energy. Therefore for a solid-RDF resource recovery facility receiving 385 tons of processable wastes per day, 79 tons per day are taken to the landfill as process residue and 306 tons per day are utilized as an energy product. At $1.00 per ton credit this yields $306 divided by 385 tons per day processed or $0.80 per ton credit for a solid-RDF facility. For a gas-RDF facility 350 tons per day are processed and 67 tons per day results in process residue, leaving 283 tons per day as fuel product. Thus at

$1.00 per ton this yields $283 divided by the processed tonnage of 350 tons per day or $0.81 per ton credit for a gas-RDF facility. Since the annual operating days are 282, the total solid-RDF annual processed tonnage at 301 tons per day is 86,290 tons per year. The total annual processed tonnage for a gas-RDF facility at 283 tons per day is 79,800 tons per year. The cost savings given here are Direct County Credits.

(E) Credit From Sale of RDF to Fuel User

Referring to Table 5-7, the potential revenues for solid and gas-RDF are given at $0.85 per MBTU. These revenues are applied as Direct County Credits.

(F) Total System Estimated Annual Costs. These costs are classified into two groups: (I) Total Annual Waste Transport Collection Costs and Recovery Plant Costs with Credits, and (II) Direct County Waste Transport Costs and Recovery Plant Costs including credits. (I) represents the total county estimated costs including waste haul costs from the centroid of each municipality. These costs are presently householder costs. (II) represents the estimated County Costs Only. Both are based on the annual county estimated waste tonnage in 1985 of 205,920 tons, for comparative purposes.

The Direct County Waste Transport Costs for Schemes I and II include the cost of transfer stations and recovery plant residual haul costs, therefore the annual costs of $301,900 and $410,400 result in $2.30 per ton and $3.15 per ton "Direct County" Cost, respectively. For these Schemes, 130,848 tons per year are transported by the county. For Schemes III, IV and V, no transfer stations are considered, only the transport costs of hauling process plant residuals to the landfill. The annual cost is much less than for Schemes I and II ($85,900, $48,800 and $51,400). However, the cost per ton does not show significant reduction over Schemes I and II ($3.85, $2.20 and $2.30). The reason is that for Schemes III, IV and V less tonnage is transported by the county than in the first two Schemes (130,848 TPY versus 22,278 TPY). Thus even though the annual cost is lower, the cost per ton does not reflect the decreased cost to the county. For Schemes VI and VII, the Direct County Cost for waste transport is zero, because residents and industries are directly responsible for transporting the wastes to the landfill sites.

Table 6-2 accounts for all costs previously developed in Chapters 5 and 6 and provides a system cost comparative matrix. Care must be exercised however, in extracting cost data directly from this table. Certain assumptions for recovery facilities and fuel users were made, in particular that one fuel user could accept the entire RDF fuel supplement supplied from an 8-hour-per-day solid-RDF processing facility. Referring to the potential fuel candidates outlined in Chapter 3, no one candidate appeared capable of accepting the entire county waste load as a fuel supplement, with the possible exception of the Dunkirk-Niagara Mohawk Power Station and the Jamestown BPU facility. Therefore, Chapter 7 is devoted to the examination of specific conditions associated with the potential energy customers outlined in Chapter 3, and to estimated specific costs.

TABLE 6-2

ANNUAL ESTIMATED COST SUMMARY OF WASTE
RECOVERY FACILITIES AND
1976

		(A)	(B)	(C)	
		Cost to Own and Operate(1) Resource Recovery Facility or Landfill; Including Plant Residual Disposal Solid-RDF at 385 TPD; Gas-RDF at 350 TPD; Landfill at 660 TPD	Cost to Landfill Wastes(6) Not accepted at Recovery Facility at $4.00/ton	Estimated Total Waste Transport Costs (Table 6- All Costs Including Collection	 Direct Costs
Scheme I					
One Recovery Facility In Jamestown With Transfer From Dunkirk	(SOLID-RDF:	$ 978,800	$ 343,200	$797,300	$301
	(GAS-RDF:	$3,439,100	$ 386,900		
Scheme II					
One Recovery Facility In Dunkirk With Transfer From Jamestown	(SOLID-RDF:	$ 978,800	$ 343,200	$887,400	$410
	(GAS-RDF:	$3,439,100	$ 386,900		
Scheme III					
Two Recovery Facilities: Jamestown and Dunkirk with Direct Haul to Both	(SOLID-RDF:	$2,417,600(7)	$ 343,200	$588,700	$ 85
	(GAS-RDF:	-	-		
Scheme IV					
One Recovery Facility In Jamestown With Direct Haul	(SOLID-RDF:	$ 978,800	$ 343,200	$802,900	$ 48
	(GAS-RDF:	$3,439,100	$ 386,900		
Scheme V					
One Recovery Facility In Dunkirk With Direct Haul	(SOLID-RDF:	$ 978,800	$ 343,200	$881,500	$ 51
	(GAS-RDF:	$3,439,100	$ 386,900		
Scheme VI					
Direct Haul to Existing Landfill Sites: Dunkirk, South Stockton and Chautauqua		(2)	-	$498,200	$
Scheme VII					
Direct Haul to Proposed Landfills Busti and Arkwright		$ 742,500(3)	-	$537,300	$

NOTES:

(1) Taken from Table 5-7: Not site-specific locations
(2) This cost is not known.
(3) Obtained from operating costs estimated in Appendix E.
(4) SOLID-RDF: 306 TPD at 282 DPY = 86290 TPY at $0.80/ton; GAS-RDF: 283 TPD at 282 DPY = 79800 TPY at $0.81/ton.
(5) Total 1985 Waste Quantity Estimate: 660 TPD at 312 DPY - 205920 TPY.
(6) SOLID-RDF: 385 TPD accepted, 275 TPD landfilled; GAS-RDF: 350 TPD accepted, 310 TPD landfilled.
(7) Taken from Table 5-4

6.9a

TABLE 6-2

MARY OF WASTE TRANSPORT SCHEMES, RESOURCE
CILITIES AND LANDFILL COSTS
1976

(C) stimated Total aste Transport Costs (Table 6-1) osts ding tion	Direct County Costs Only	(D) Estimated Landfill(4) Cost Savings by Utilizing Wastes As Energy Instead of Landfilling	(E) Credit From Sale(1) OF RDF To Fuel User	(F) Total System Estimated Annual Costs (I) For Waste Transport Costs Including All Collection Haul Costs: Annual	Cost Per Ton (5)	(II) For Direct County Waste Transport Costs: Annual	Cost Per Ton (5)
,300	$301,900	$69,000	$749,000	$1,301,300	$ 6.30	$ 805,900	$ 3.90
		$64,600	$516,200	$4,042,500	$19.60	$3,547,100	$17.20
,400	$410,400	$69,000	$749,000	$1,391,400	$ 6.75	$ 914,400	$ 4.45
		$64,600	$516,200	$4,132,600	$20.05	$3,655,600	$17.75
,700	$ 85,900	$69,000	$749,000	$2,531,500	$12.30	$2,028,700	$ 9.85
		-	-	-	-	-	-
,900	$ 48,800	$69,000	$749,000	$1,306,900	$ 6.35	$ 552,800	$ 2.70
		$64,600	$516,200	$4,048,100	$19.65	$3,294,000	$16.00
,500	$ 51,400	$69,000	$749,000	$1,385,500	$ 6.70	$ 555,400	$ 2.70
		$64,600	$516,200	$4,126,700	$20.00	$3,296,600	$16.00
,200	$ 0	-	-	$ 498,200 Haul Cost Only	-	-	-
,300	$ 0	-	-	$1,279,800	$ 6.20	$ 742,500	$ 3.60

.81/ton.

Summarizing Table 6-2, the data presented provides relative system costs. It does appear that a solid-RDF may be economically competitive with the proposed future landfills. Also when the total cost picture is examined, transfer station versus direct haul to resource recovery facilities does not appear to offer significant direct transport cost savings; however return to collection routes for areas located near the transfer stations will be faster than direct haul.

The cost of the gas-RDF facility is significantly higher for all alternatives examined, as would be expected. The cost of locating two solid-RDF resource recovery facilities, one each in Jamestown and Dunkirk, is significantly more than any single solid-RDF resource recovery facility using transfer station or direct haul. The significant higher cost for two solid-RDF plants can be attributed to the high annual costs associated with each facility and the relatively minor impact of direct haul cost savings of wastes to the two separate facilities.

More site-specific conditions for resource recovery facilities will be examined in Chapter 7. Detailed cost estimates will be provided for the various alternative facilities, rather than only the solid or gaseous resource recovery facility in general.

WASTE RECEIVING FACILITIES AT TRANSFER STATION AND RESOURCE RECOVERY FACILITIES

A schematic configuration of the waste-receiving area and traffic flow patterns for a transfer station at Dunkirk are given in Figure 6-8. The transfer station would accommodate auto-delivered wastes at a refuse transfer truck which when full, would be driven to the refuse-receiving site of the transfer station and dumped. Thus auto traffic would not interfere with the transfer station traffic flow. The facility will consist of a 10 foot by 12 foot refuse-receiving pit with a live bottom feed conveyor. The refuse is conveyed to the compactor and pushed into the transfer trailer. To maximize the dumping area available, the transfer trailer has an inclined driveway to a compactor mechanism. This provides dumping access to the refuse pit conveyor from the rear of the building as well as the front, and therefore provides four dumping quadrants to the refuse pit conveyor for incoming vehicles. The grade to the entire transfer station, front and rear, is thus kept the same. To eliminate turn-around times for large packer trucks, the front dumping bay closest to the entrance could be reserved for these trucks. The length of each receiving pit is 35 feet and the building is approximately 80 feet by 50 feet. This would provide approximately 800 cubic yards (120 tons) of refuse storage (five feet deep), including the refuse receiving pits in case of a breakdown at the facility. A front end loader (not illustrated) has been allocated for each transfer station to service floor dumping when necessary. From the field weighing survey conducted at the landfill sites in April-May 1975, the average hourly flow of refuse expected at the Dunkirk transfer station would be 28 tons per hour, with a maximum hourly flow of 40 tons per hour. Therefore, at the maximum flow rate approximately 3 hours of storage capacity is available at the transfer station, with 4.5 hours storage capacity at the average hourly flow.

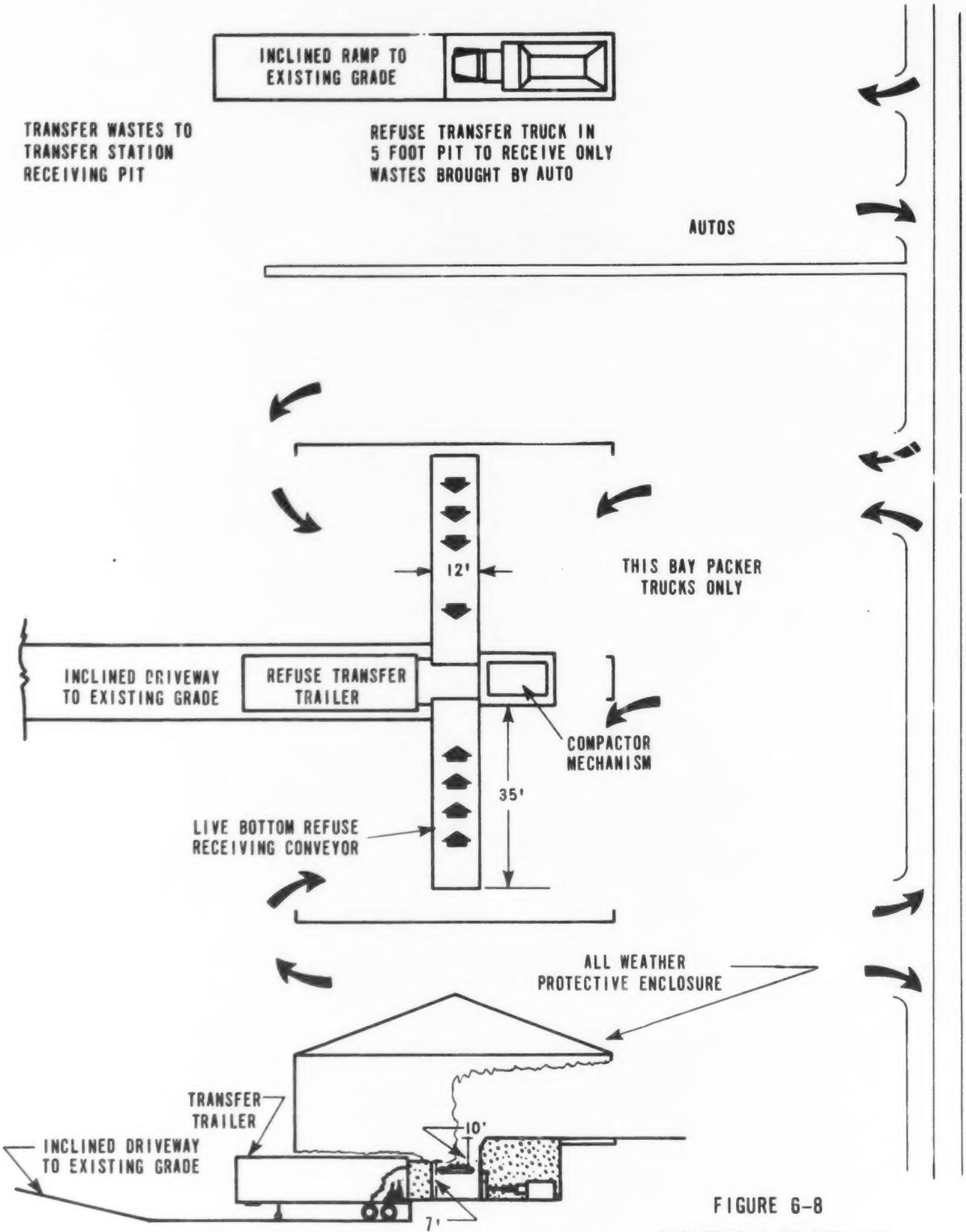

INCLINED RAMP TO EXISTING GRADE
TRANSFER WASTES TO TRANSFER STATION RECEIVING PIT
REFUSE TRANSFER TRUCK IN 5 FOOT PIT TO RECEIVE ONLY WASTES BROUGHT BY AUTO
AUTOS
12'
THIS BAY PACKER TRUCKS ONLY
INCLINED DRIVEWAY TO EXISTING GRADE
REFUSE TRANSFER TRAILER
COMPACTOR MECHANISM
35'
LIVE BOTTOM REFUSE RECEIVING CONVEYOR
ALL WEATHER PROTECTIVE ENCLOSURE
TRANSFER TRAILER
INCLINED DRIVEWAY TO EXISTING GRADE
10'
7'

FIGURE 6-8

CHAUTAUQUA COUNTY, NY
TRANSFER STATION
REFUSE RECEIVING AREA

GILBERT ASSOCIATES, INC.

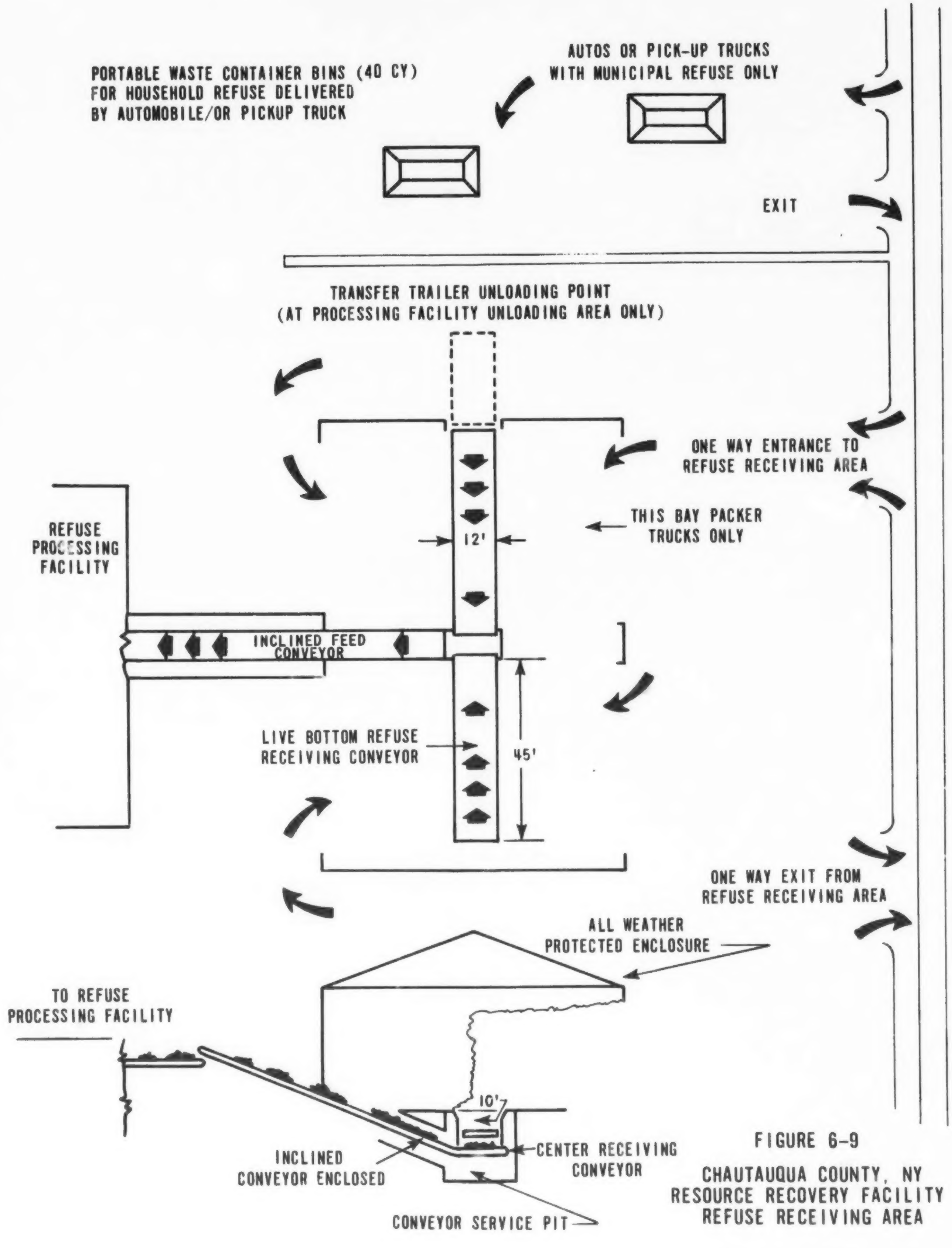

PORTABLE WASTE CONTAINER BINS (40 CY)
FOR HOUSEHOLD REFUSE DELIVERED
BY AUTOMOBILE/OR PICKUP TRUCK
AUTOS OR PICK-UP TRUCKS
WITH MUNICIPAL REFUSE ONLY
EXIT
TRANSFER TRAILER UNLOADING POINT
(AT PROCESSING FACILITY UNLOADING AREA ONLY)
ONE WAY ENTRANCE TO
REFUSE RECEIVING AREA
THIS BAY PACKER
TRUCKS ONLY
12'
REFUSE
PROCESSING
FACILITY
INCLINED FEED
CONVEYOR
LIVE BOTTOM REFUSE
RECEIVING CONVEYOR
45'
ONE WAY EXIT FROM
REFUSE RECEIVING AREA
ALL WEATHER
PROTECTED ENCLOSURE
TO REFUSE
PROCESSING FACILITY
10'
INCLINED
CONVEYOR ENCLOSED
CENTER RECEIVING
CONVEYOR
CONVEYOR SERVICE PIT

FIGURE 6-9

CHAUTAUQUA COUNTY, NY
RESOURCE RECOVERY FACILITY
REFUSE RECEIVING AREA

GILBERT ASSOCIATES, INC.

The transfer station for the Jamestown Area would be basically the same as that illustrated in Figure 6-8, with the exception that the refuse-receiving pit length would be 40-45 feet to accommodate the expected larger, waste flow. Capital and operating costs for the Dunkirk and Jamestown transfer stations are given in Appendix F.

The refuse-receiving area at the Resource Recovery facility is illustrated in Figure 6-9. Since the resource-recovery receiving area will serve for local wastes as well as wastes transferred from a transfer station, sufficient dumping area must be provided for vehicles delivering wastes not taken to the transfer station but direct-hauled to the resource recovery plant refuse receiving area. Auto-delivered wastes will be disposed at a separate area away from the main refuse receiving area. Two 40 cubic yard roll on/roll off containers will be used to collect these wastes. When filled, the same truck that is utilized to haul the roll on/roll off containers for recovery plant residue to the landfill is used to transport the 40 cubic yard auto waste containers to the refuse-receiving pit. A separate position at the end of the refuse-receiving pit is designated to receive wastes brought by transfer trailer from the transfer station. In this manner the transfer trailer will not interfere with normal dumping or traffic flow.

Refuse is dumped into the refuse receiving pit (10 feet by 12 feet by 45 feet) and conveyed by a pit conveyor to the cross-feed inclined conveyor, which transports the wastes into the resource recovery refuse processing facility. Sufficient area should be left beneath the pit conveyors for service access. There are four bays to provide area for vehicles to dump wastes. The building is approximately 80 feet by 110 feet.

Average hourly waste flow anticipated at the resource recovery facility refuse receiving area, based on the April-May field weighing survey, is 45 tons per hour, with a maximum of 80 tons per hour. Storage capacity of wastes in the refuse receiving building at a depth of 5 feet, including the receiving pits, is approximately 1780 cubic yards or 260 tons. Therefore, in the event of a breakdown at the resource recovery facility, approximately 6 hours of storage capacity would be available at the refuse receiving facility at the average 45 tons per hour waste flow rate, with 3.3 hours of storage capacity available at the maximum waste flow rate of 80 tons per hour.

There will also be a front end loader to service the refuse receiving area in the event floor tipping is required.

CHAPTER 7

SITE SPECIFIC ENERGY RECOVERY SCHEMES FOR CHAUTAUQUA COUNTY

INTRODUCTION

The preceding chapters of this report have presented general data and concepts concerning a variety of waste transport schemes and resource recovery systems. Based on this information the following potential users of a refuse derived fuel have been selected for consideration:

- Jamestown BPU Carlson Station
- Niagara-Mohawk Dunkirk Station
- State University of New York, Fredonia
- Cummins Engine Company

Figure 7-1 shows the location of these potential RDF fuel users.

Based on the expressed needs of the stated potential fuel users, as outlined in Chapter 3, seven resource recovery/waste transport alternatives will be examined for specific conditions of fuel users. These are:

Alternative A - Energy recovery at the Jamestown BPU Carlson Electric Generating Station, solid refuse-derived fuel.

Alternative B - Energy recovery at Jamestown BPU Carlson Electric Generating Station, Purox System (Gasified - RDF).

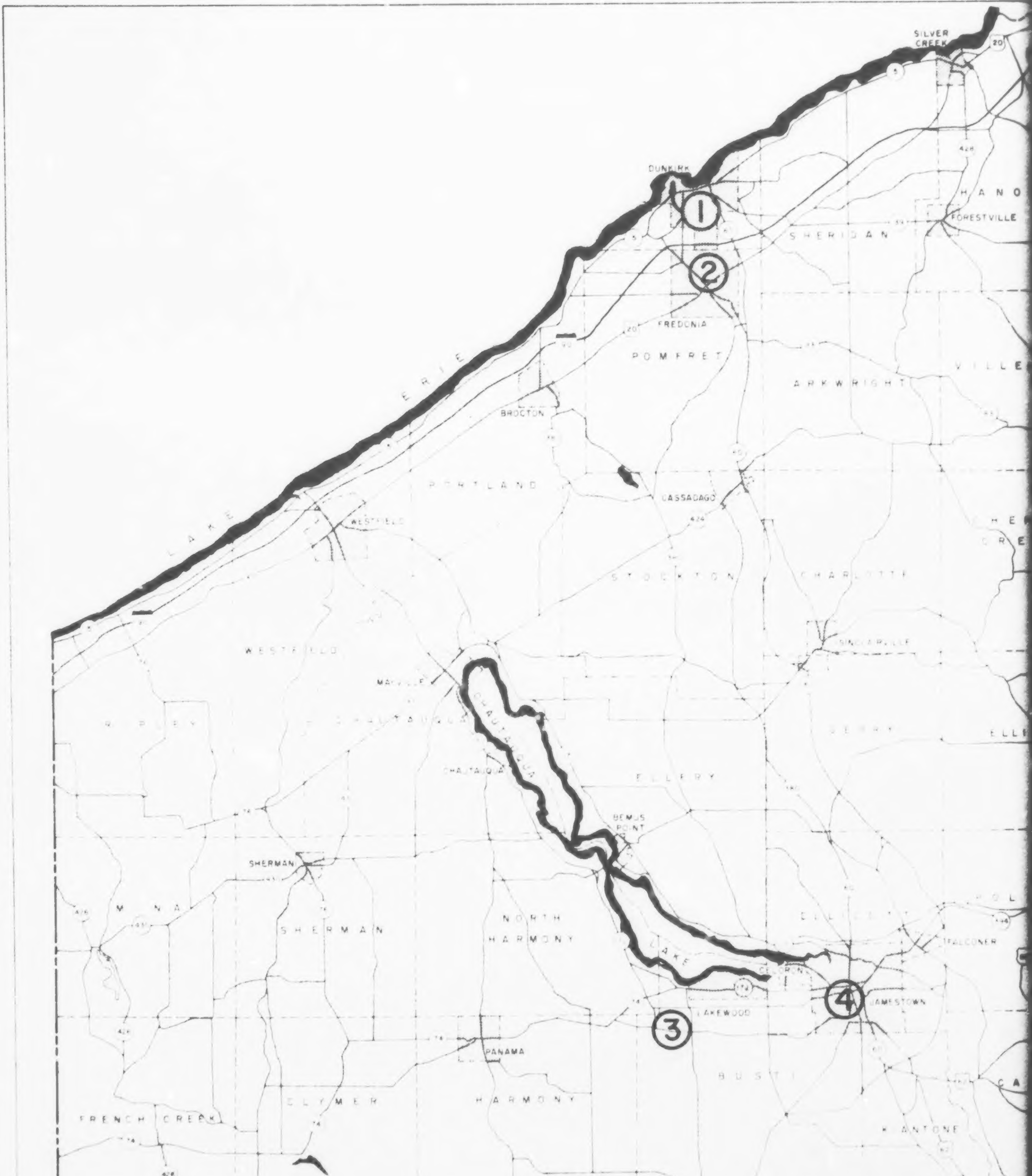
Alternative C-1 - Energy recovery at two locations: (1) SUNY - Fredonia utilizing Gasified - RDF (Purox), and (2) Jamestown BPU Carlson Station, Solid - RDF.

Alternative C-2 - Energy recovery at two locations: (1) Cummins Engine Company, and (2) Jamestown BPU Carlson Station, Solid RDF.

Alternative D-1 - Energy recovery at Niagara-Mohawk Dunkirk Power Station, Solid - RDF from Chautauqua and Erie Counties.

Alternative D-2 - Energy recovery at Niagara-Mohawk Dunkirk Power Station, solid RDF from Chautauqua County only.

Alternative E - Transfer Chautauqua County processable wastes to the Erie County Resource Recovery Facility for processing into Solid - RDF.


SILVER CREEK
20
5
DUNKIRK
①
②
HANO
FORESTVILLE
SHERIDAN
LAKE ERIE
FREDONIA
20
90
POMFRET
ARKWRIGHT
VILLE
BROCTON
PORTLAND
CASSADAGA
424
WESTFIELD
STOCKTON
CHARLOTTE
SINCLAIRVILLE
WESTFIELD
MAYVILLE
RIPLEY
CHAUTAUQUA
CHAUTAUQUA LAKE
CHAUTAUQUA
GERRY
ELLI
ELLERY
BEMUS POINT
SHERMAN
MINA
SHERMAN
NORTH HARMONY
LAKE
CELORON
FALCONER
④
JAMESTOWN
LAKEWOOD
③
PANAMA
BUSTI
CLYMER
HARMONY
FRENCH CREEK
KIANTONE
74
426
430
394
60
62
CA

11,160

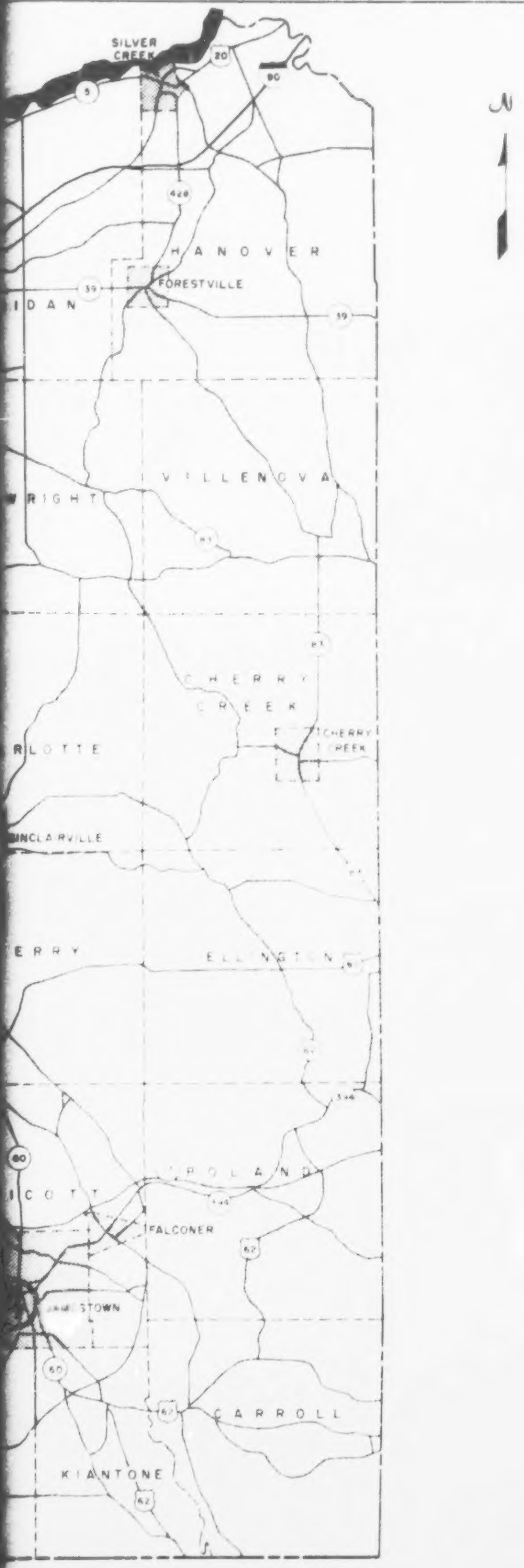

SILVER CREEK
20
90
5
428
HANOVER
FORESTVILLE
39
39
VILLENOVA
CHERRY CREEK
CHERRY CREEK
SINCLAIRVILLE
ELLINGTON
60
POLAND
FALCONER
62
JAMESTOWN
60
62
CARROLL
KIANTONE
62

FIGURE 7-1

POTENTIAL USER LOCATIONS FOR ENERGY DERIVED FROM SOLID WASTES

LEGEND

① NIAGARA-MOHAWK POWER GENERATION STATION

② STATE UNIVERSITY OF N.Y., FREDONIA CAMPUS

③ CUMMINGS ENGINE COMPANY

④ JAMESTOWN BOARD OF PUBLIC UTILITIES POWER GENERATION STATION

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK
GILBERT ASSOCIATES, INC.
Reading, Pa.

TRANSFER STATION COSTS

Before proceeding with the discussion of Alternatives, transfer station costs developed for the following alternatives will be examined. Transfer station annual debt service and operating costs are presented in Appendix F. These were applied in Chapter 6, with the generalized waste transport scheme analysis. Capital and operating costs for transfer station systems in the Dunkirk and Jamestown areas are shown in Table 7-1 (taken from Appendix F). The operating costs include only mileage costs, labor and sinking funds. Table 7-2 provides the estimated annual debt service and operating costs of transfer station systems for the Dunkirk and Jamestown areas. Included in this cost breakdown is the 25% N.Y.D.E.C. Construction Grant for transfer station systems (a). These transfer station annual debt service and operating costs will appear in the annual cost summary of Resource Recovery Alternative Systems - Table 7-27. Included in Table 7-27 with the transfer station costs will be the resource recovery processing plant residual waste transport costs. These combined county costs will be given under "Direct County Total Waste Transport Costs."

PROJECT COST ESTIMATES

The project cost estimates included in this chapter were developed from manufacturers costs obtained in late 1975 and early 1976.

(a) The N.Y.D.E.C. construction grant for waste energy and materials recovery facilities is 50 percent.

TABLE 7-1

TRANSFER STATION CAPITAL AND ANNUAL OPERATING COST ESTIMATES FOR THE DUNKIRK AND JAMESTOWN AREA

1976

I. DUNKIRK AREA TRANSFER STATION

Capital Costs:		
A.	Transfer Station	$ 366,000
B.	Tractors (2)	60,000
C.	Trailers (2)	54,000
	TOTAL	$ 480,000
Annual Operating Costs[1]:		
A.	Transfer Station	$ 77,500
B.	Tractors (2)	84,800
C.	Trailers (2)	25,200
	TOTAL	$ 187,500

II. JAMESTOWN AREA TRANSFER STATION

Capital Costs:		
A.	Transfer Station	$ 479,000
B.	Tractors (3)	90,000
C.	Trailers (4)	108,000
	TOTAL	$ 677,000
Annual Operating Costs[1]:		
A.	Transfer Station	$ 79,200
B.	Tractors (3)	135,100
C.	Trailers (4)	46,300
	TOTAL	$ 260,600

---

[1] Includes mileage costs, labor and sinking funds; refer to Appendix F.

TABLE 7-2

ESTIMATED TRANSFER STATION ANNUAL DEBT SERVICE AND OPERATING COSTS FOR THE DUNKIRK AND JAMESTOWN AREA, INCLUDING THE N.Y.D.E.C. 25% CONSTRUCTION GRANT(1)

1976

I. DUNKIRK AREA TRANSFER STATION

1.	Capital Costs	$ 480,000
2.	25% Construction Grant from N.Y.D.E.C.	120,000
3.	Local Capital Cost Share	360,000
4.	Annual Costs:	
	- Debt Service @ 7% 10 years ($360,000)	$ 51,300
	- Operating	187,500
	TOTAL	$ 238,800

II. JAMESTOWN AREA TRANSFER STATION

1.	Capital Costs	$ 677,000
2.	25% Construction Grant from N.Y.D.E.C.	169,300
3.	Local Capital Cost Share	507,700
4.	Annual Costs:	
	- Debt Service @ 7% 10 years ($507,700)	$ 72,300
	- Operating	260,600
	TOTAL	$ 332,900

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(1) 25% N.Y.D.E.C. construction grant for transfer stations.

ALTERNATIVE A

ENERGY RECOVERY AT THE JAMESTOWN BPU CARLSON STATION UTILIZING A SOLID REFUSE-DERIVED FUEL

Jamestown BPU would be the only RDF fuel user for this alternative. A general flow schematic of this system operation is illustrated in Figure 7-2. The solid-RDF resource recovery facility would be located several hundred feet from the BPU Carlson station, just off Main Street.

A proposed general site plan of the resource recovery facility is given in Figure 7-3. Wastes would be delivered to the facility as outlined in Waste Transport Scheme I: Recovery Facility in Jamestown with Transfer Station in Dunkirk. Processable wastes would be "direct hauled" to the resource recovery receiving area, similar to the schematic illustration in Figure 6-9. The "direct hauled" waste area would correspond to that area outlined south of Dunkirk in Figure 6-1, Waste Transport Scheme I. Daily total incoming "direct hauled" wastes would be approximately 258 tons. A transfer station would be located in Dunkirk and wastes transferred by transfer trailer to Jamestown in the amount of 127 tons per day. The Dunkirk transfer station service area is outlined in Figure 6-1. The transfer station would be similar to the illustration in Figure 6-8.

The total incoming daily processable waste load at the resource recovery facility is 385 tons. The resource recovery facility would operate over a sixteen hour day, processing all incoming wastes. The prepared refined fuel fraction would be utilized by the BPU over a 24 hour period, averaging approximately 12 tons per hour. This would be equivalent to generating approximately 102,500 pph(1) over 24 hours. Referring to Table 3-11 the 1975 average generated daily load is approximately 27,900 KWH. This translates to approximately 305,000 pph of steam(2) over 24 hours. Comparing the Solid-RDF and coal steam producing capacity at average load level, slightly more than 30 percent would be generated from the solid RDF, with less at higher load demands. Approximately 192 tons of refined fuel fraction (RFF) would be sent from the processing facility directly to the BPU boilers during the 16 hour operating day. The remaining 95 tons of RFF would be stored in a RFF storage silo, located adjacent to the processing facility. From the storage silo, RFF would be sent to the BPU boilers at the same 12 tons per hour rate for the remaining 8 hours of the day. The total storage capacity of the silo would be about 100 tons of refined fuel fraction.

Process residuals of 79 tons per day from the processing facility would be taken to the proposed Busti landfill or, if markets were found for the recovered ferrous and other constituents, they would be taken to the customers.

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(1) pph - pound per hour.

(2) From 1975 BPU annual report: 1.055 lbs coal/KWH; assumed, 12,500 Btu/lb coal and 1082 lbs steam per MBtu

The resource recovery system that would be utilized to process the incoming 385 tons of wastes into a refined fuel fraction is the same system described in Chapter 5 and illustrated in Figure 5-2. The refined fuel fraction (RFF) would consist of 287 tons per day of combustible material at 6630 BTU per pound, 15 percent inerts and 16 percent moisture for a 75% RFF.

Table 7-3 provides the estimated capital costs of Alternative A resource recovery system at $5,130,000. The estimated annual operating expenditures for Alternative A are given in Table 7-4 at $880,200. Since the facility will be operating over a 16 hour period, two shifts will be required for operating the facility. Daily preventive maintenance will be performed on the 8 hour "down" period. Table 7-5 gives the estimated cost per ton to own and operate the Resource Recovery facility at $14.50 per ton of waste processed for Alternative A. The cost per ton and the Annual Cost given earlier do not reflect potential revenue from the sale of RDF or the 50 percent construction grant.

Estimated potential revenue from the sale of the Refined Fuel Fraction is based on a 75 percent value of the current fuel costs of the BPU. Appendix H contains correspondence from the Jamestown Board of Public Utilities expressing willingness to pay 75% of their current fuel costs.

In the 1975 Jamestown BPU annual report coal costs were stated to be $28.28 per ton. Assuming the energy content of the coal at 12,500 BTU per pound, this yields $1.13 per million BTU, equating at 75% to $0.85 per million BTU (MBTU) the value for the refuse derived fuel. Comparing the value of coal to refuse-derived fuel at 10.88 MBTU per ton of RFF, this yields $9.25 per ton. (Refer to Figure 5-3.) Therefore, the estimated annual revenue from the sale of solid-RDF to the Jamestown BPU @ $0.85 per MBTU is $749,000.

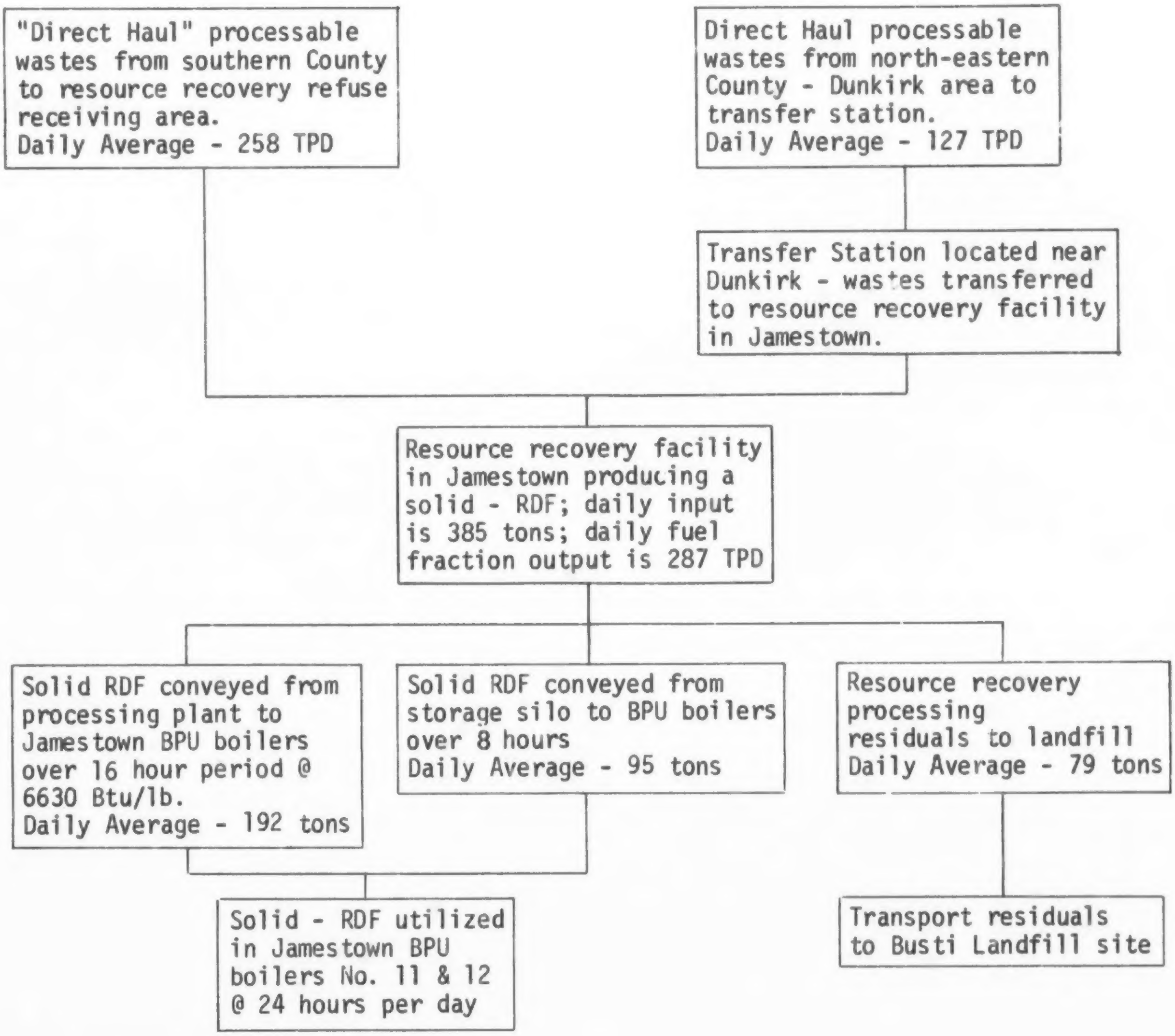
Table 7-6 provides a Cost Summary of the estimated capital and operating costs of Alternative A recovery facility, including the 50% New York State Department of Environmental Conservation Construction grant. Table 7-6 also shows the cost difference by charging the Jamestown BPU for the refuse derived fuel at $0.85 per MBTU or giving the RDF at no charge. If the New York State Department of Environmental Conservation 50% construction grant is included the estimated total annual cost is $1,300,200 or $12.00 per ton of refuse processed - 385 TPD. If the estimated annual revenue from the sale of the RDF to the BPU is included ($749,000), the estimated annual cost is reduced to $551,200, or at 282 operating days per year, $5.10 per ton. If no revenue is obtained for the RDF, the estimated annual cost is $1,300,200 or $12.00 per ton, approximately 2.5 times more than for gaining revenue from RDF.

Table 7-27 provides a Total System Cost Summary for Alternative A, including the estimated cost of Direct County Waste Transport Cost, including transfer station at $287,600, the estimated cost to landfill wastes not accepted at the recovery facility at $343,200, the estimated annual landfill cost savings by utilizing the wastes as a fuel at $69,000, the estimated credit for sale of RDF at $749,000 and the estimated annual total cost at $1,113,000 ($5.40 per ton) for sale of RDF and $1,862,000 ($9.00 per ton) for no charge of the RDF, respectively.

FIGURE 7-2

ALTERNATIVE A

ENERGY RECOVERY AT JAMESTOWN B.P.U. CARLSON STATION UTILIZING A SOLID REFUSE DERIVED FUEL



"Direct Haul" processable wastes from southern County to resource recovery refuse receiving area.
Daily Average - 258 TPD

Direct Haul processable wastes from north-eastern County - Dunkirk area to transfer station.
Daily Average - 127 TPD

Transfer Station located near Dunkirk - wastes transferred to resource recovery facility in Jamestown.

Resource recovery facility in Jamestown producing a solid - RDF; daily input is 385 tons; daily fuel fraction output is 287 TPD

Solid RDF conveyed from processing plant to Jamestown BPU boilers over 16 hour period @ 6630 Btu/lb.
Daily Average - 192 tons

Solid RDF conveyed from storage silo to BPU boilers over 8 hours
Daily Average - 95 tons

Resource recovery processing residuals to landfill
Daily Average - 79 tons

Solid - RDF utilized in Jamestown BPU boilers No. 11 & 12 @ 24 hours per day

Transport residuals to Busti Landfill site

POTENTIAL AREA FOR RESOURCE RECOVERY FACILITY
JAMESTOWN BPU CARLSON STATION
JAMESTOWN, NEW YORK

ALTERNATIVE A

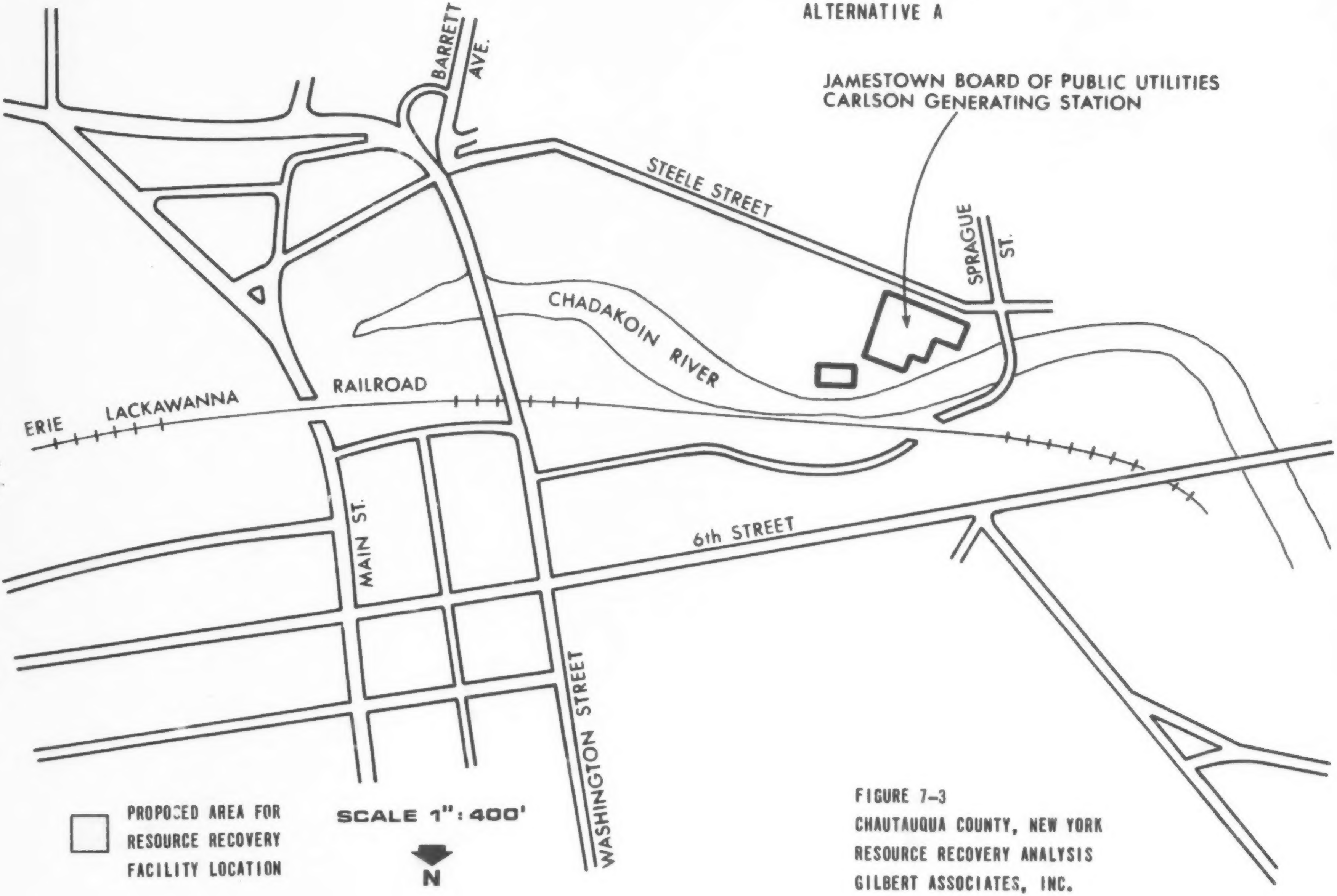

JAMESTOWN BOARD OF PUBLIC UTILITIES
CARLSON GENERATING STATION
BARRETT AVE.
STEELE STREET
SPRAGUE ST.
CHADAKOIN RIVER
ERIE LACKAWANNA RAILROAD
MAIN ST.
6th STREET
WASHINGTON STREET
PROPOCED AREA FOR RESOURCE RECOVERY FACILITY LOCATION
SCALE 1": 400'
N

FIGURE 7-3
CHAUTAUQUA COUNTY, NEW YORK
RESOURCE RECOVERY ANALYSIS
GILBERT ASSOCIATES, INC.

7.5 b

TABLE 7-3

ALTERNATIVE - A
ENERGY RECOVERY AT JAMESTOWN BPU

CAPITAL COST ESTIMATE
RESOURCE RECOVERY FACILITY
385 TONS PER DAY
1976

PROCESSING/RECOVERY PLANT

I.	BUILDING		
1.	Land Acquisition		$ 60,000
2.	Site Preparation, Grading, etc.		120,000
3.	Building, foundations, scale		662,000
4.	Electrical		280,000
5.	Utilities, plumbing, etc.		70,000
		Subtotal	$1,192,000
II.	Processing Equipment - Installed		
1.	Primary Shredder w/feed & take away oscillating conveyor		425,000
2.	Intermediate Conveyors - Into and Out of Trommel		94,000
3.	Magnetic Separator		65,000
4.	Trommel		125,000
5.	Second Stage Shredder		190,000
6.	Allowance for pneumatic feed		260,000
7.	Refuse Storage Silo		500,000
8.	Dust Control System		85,000
		Subtotal	$1,744,000
III.	Refuse Receiving and Handling Facility		
1.	Receiving Waste Pit Conveyors and cross feed conveyor		125,000
2.	Construction of Refuse Receiving Pit and associated accessories		50,000
3.	Transportation truck for roll on/roll off containers		55,000
4.	Two 40 C.Y. roll on/roll off open top waste containers for Processing Plant residuals		14,000
5.	Three 40 C.Y. roll on/roll off open top waste containers. Two for auto delivered wastes plus one spare		21,000
6.	Front end loader and accessories		120,000
		Subtotal	$ 385,000

TABLE 7-3 (Cont'd)

CAPITAL COST ESTIMATE

IV.	Boiler Modifications	Subtotal	$ 550,000
	Subtotal Item I, II, III & IV		3,871,000
	Construction Contingency - 15%		581,000
	Engineering, Supervision & Admin. 15% of total		678,000
		TOTAL	$5,130,000

TABLE 7-4

ALTERNATIVE - A
ENERGY RECOVERY AT JAMESTOWN BPU

ESTIMATED ANNUAL RESOURCE RECOVERY FACILITY OPERATING COSTS
385 TPD - SIX DAYS/WEEK*
1976

1.	Labor - 11 personnel for two eight hour shifts/ day - 6 days/week	$300,000
	35% allowance - benefits, overtime	105,000
	Subtotal	$405,000
2.	Maintenance & Repair - parts replacement etc.	
	Facility-Building etc.	$ 10,000
	Equipment	180,000
	Subtotal	$190,000
3.	Heating, Water, and Miscellaneous Supplies	$ 20,000
4.	Fuel, Maintenance & Repair Front End Loader, Residual Hauling Truck and Containers	$ 40,000
5.	Electric Power	$120,000
6.	Processing Facility Residue Disposal Costs	$ 89,100
7.	Sinking fund for Residue Haul Truck and Containers @ 5.5% for 5 years ($90,000)	$ 16,000
	Total Annual Estimated Plant Operating Costs	$880,200

* 282 operating days per year

TABLE 7-5

ALTERNATIVE - A
ENERGY RECOVERY AT JAMESTOWN BPU

ESTIMATED COST PER TON OF REFUSE PROCESSED TO OWN AND OPERATE RESOURCE RECOVERY FACILITY
1976

			Annual Cost
1.	Estimated Total Debt Service @ 10 years 7% ($5,130,000)		$ 730,400
2.	Coverage @ 15% ($730,400)		$ 109,500
3.	Estimated Annual Operating Cost		$ 880,200
		TOTAL	$1,720,100

Estimated Average Annual Refuse Processed in 1985-385 TPD @ 282 operating days per year yields 108,570 tons per year

ALTERNATIVE - A

Estimated Cost Per Ton to Own and Operate Resource Recovery Facility

$$\frac{\$1{,}720{,}100}{108{,}570\ \text{TPY}} = \$15.85/\text{ton}^*$$

* Excludes revenue from sale of RDF and 50% Construction Grant from N.Y.S.D.E.C.

TABLE 7-6

ALTERNATIVE - A
ENERGY RECOVERY AT JAMESTOWN BPU
1976

COST SUMMARY

		Sale of RDF to BPU @ $0.85 per MBTU	No Charge for RDF to BPU
1.	Estimated Capital Cost	$5,130,000	$5,130,000
2.	50% Construction Grant from New York State D.E.C.	-2,565,000	-2,565,000
3.	Capital Cost; Local Share	$2,565,000	$2,565,000
4.	Annual Costs		
	- debt service @ 7% 10 years	$ 365,200	$ 365,200
	- coverage @ 15%	54,800	54,800
	- operating	880,200	880,200
	TOTAL	$1,300,200 ($12.00/ton)	$1,300,200 ($12.00/ton)
5.	Estimated Annual Potential Revenue from RDF	-$ 749,000	-$ 0
6.	Estimated Annual Cost to own and operate including Revenue Credits	$ 551,200	$1,300,200
7.	Estimated Daily Cost @ 282 DPY	$ 1,955	$ 4,610
8.	Estimated Cost Per Ton (Received - 385 TPD)	$ 5.10	$ 12.00

ALTERNATIVE B

ENERGY RECOVERY AT THE JAMESTOWN BPU CARLSON STATION UTILIZING THE PUROX SYSTEM (GASIFIED-RDF)

For this alternative the Jamestown BPU is again considered the only fuel user, utilizing a gasified RDF. A general flow diagram of the system plan and operation is illustrated in Figure 7-4. This alternative system plan is exactly the same as alternative A, only a gaseous RDF (Purox Process) is produced instead of a solid-RDF. All other aspects are the same.

The location of the Purox System would be in the same general location as the solid-RDF processing facility, as shown in Figure 7-3. Waste would be delivered to the recovery facility as outlined in Alternative A, by waste transport (Scheme I, Figure 6-1), with a transfer station in Dunkirk. Approximately 223 tons per day would be "direct hauled" to the receiving area of the resource recovery facility, and approximately 127 tons per day would be transferred in from Dunkirk. Figures 6-8 and 6-9 illustrate the transfer station and recovery facility receiving area configurations, respectively.

Total incoming wastes to this facility would be approximately 350 tons per day. It would operate 24 hours per day, creating a need for storage of approximately 16 hours of wastes at the resource recovery refuse receiving area. At an hourly flow rate into the Purox reactor of 14.6 tons per hour for 8 hours, this is equivalent to about 117 tons of refuse. Since refuse will be delivered over an 8-hour period, approximately 233 tons of unprocessed waste will be stored and metered into the reactor over the next 16 hours. The refuse receiving building should therefore be approximately 110' x 80' and the refuse receiving pit 10' x 12' x 45'. (Figure 6-9.) If piled 5 feet high, the building and refuse receiving pits would hold approximately 274 tons. Since a maximum of 233 tons will require storage at any one time, only 85% of the theoretical volume of the building will be utilized at 5 feet.

As mentioned previously the estimated hourly feed rate into the reactor system is 14.6 tons per hour. The Purox gas output has an energy value of 7.5 MBTU per ton of processed waste. Assuming the gas will have a combustion efficiency of 70%, this translates to approximately 1,700,000 pounds of steam per day or 70,800 pounds of steam per hour (pph), at 24 hours per day. As discussed in Alternative A, the average daily generated load for 1975 at the BPU station is approximately 27,900 KWH, yielding 305,000 pph of steam. Comparing the gas-RDF and coal steam producing capacity at average load level, approximately 24 percent of the steam could be generated from the gaseous-RDF.

Approximately 252 tons of fuel gas would be produced daily from the Purox system, about 11 tons of ferrous metals and 56 tons of granular aggregate, for a total of 67 tons of inerts. (Figure 5-4 - Purox System Flow Chart.)

The 67 tons of inerts would be taken to the Busti Landfill or sent to customers, if buyers could be found.

The Purox system described in Chapter 5 would be the same system utilized for the BPU to generate a gaseous-RDF. Referring to Figure 7-3, the general site location of the Purox reactor would probably be approximately 500-600 feet from the BPU station, at the same location of the solid-RDF processing facility shown. Gaseous RDF would then be conveyed approximately 500-800 feet to BPU boilers No. 11 and 12.

Table 7-7 indicates the estimated capital and annual costs for the Alternative B resource recovery facility, which are $19,460,600 and $5,086,400 ($51.50 per ton) respectively. This does not include revenue from the sale of RDF, or the effect of a construction grant. The facility will be operating for six days per week, 24 hours per day, with the reactor "banked" for the seventh day.

Estimated potential revenue for the sale of gaseous RDF is based on the BPU price for fuel less 25%. Therefore the estimated annual potential revenue at 350 tons per day is $516,200. Table 7-8 provides a Cost Summary of estimated capital and operating costs of the Purox System for Alternative B, including, a 50% New York State Department of Environmental Conservation Grant. Also indicated in Table 7-8 is the cost differential of operating cost from the sale of gasified RDF at $0.85 per MBTU, or giving the Refuse Derived Fuel to the BPU at no charge.

If the New York State Department of Environmental Conservation 50% construction grant is admitted to the financing plan, the estimated total annual cost is $3,493,200, less $516,200 for the sale of gaseous RDF to the BPU, resulting in a net estimated annual operating cost of $2,977,000 or, at 282 operating days per year, $30.15 per ton. If BPU is not charged for the gaseous RDF, the estimated annual cost is $3,493,200 or $35.40 per ton processed - approximately 1.2 times more than if revenue is realized from the gaseous RDF.

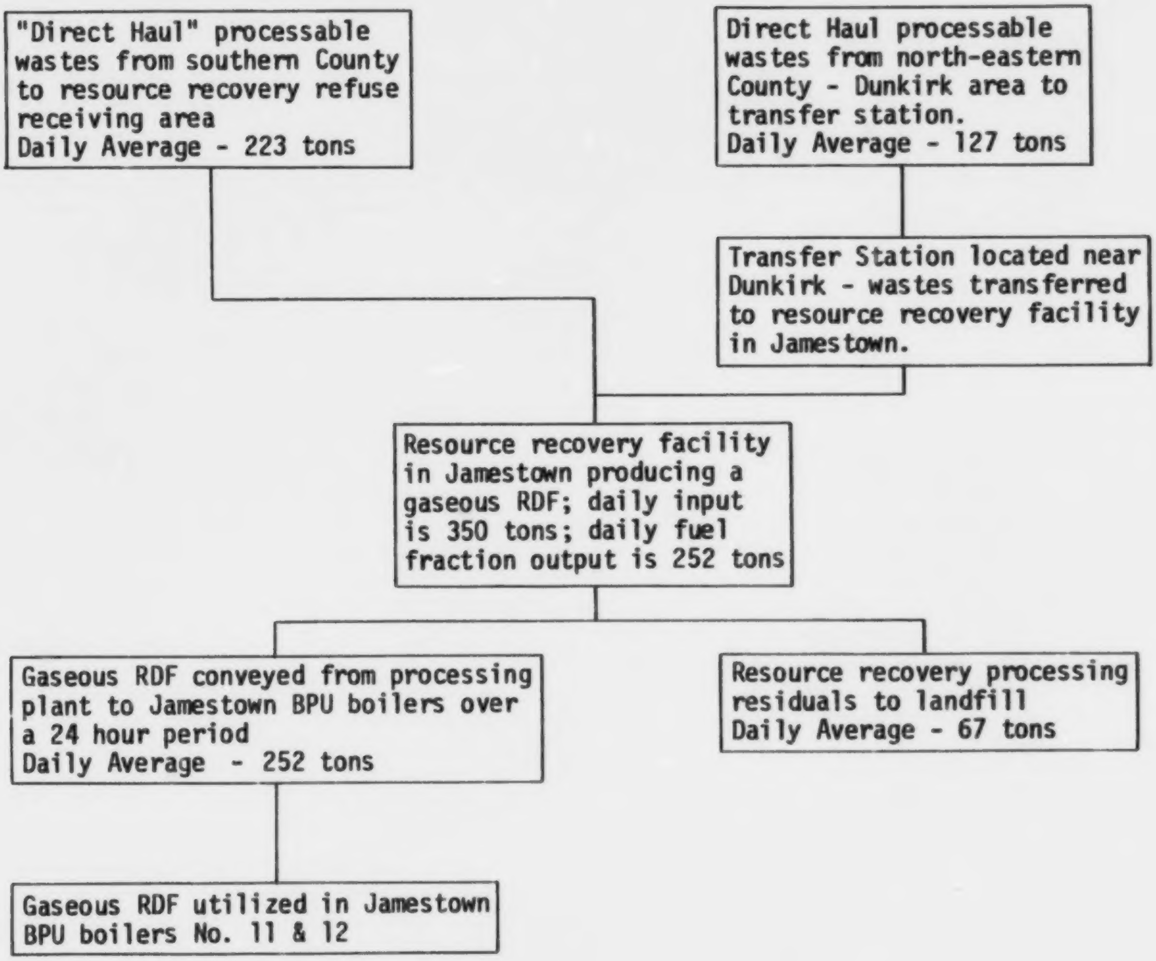
If in some manner a 100% construction grant were made available to construct the Alternative B facility, the resulting local capital costs would be eliminated. Referring to Table 7-9, the estimated capital cost is $19,460,600. However a 100% construction grant would leave only the annual operating costs to be paid for locally, amounting to an estimated $1,900,000. If the BPU is charged for the gaseous RDF at $0.85 per MBTU, the resultant estimated annual cost is $1,383,800, or $14.00 per ton processed. Should the BPU not be charged for the gaseous RDF, the estimated annual cost is $1,900,000 or $19.25 per ton processed.

Table 7-27 gives a summary of Alternative B total system cost with a 50% and 100% construction grant. It also includes the estimated direct county waste transport cost at $287,600, the estimated cost to landfill wastes not accepted at the recovery facility at $386,900, the estimated annual landfill cost savings by utilizing the wastes as a fuel at $64,000, the estimated credit for sale of gaseous RDF at $516,200, the estimated annual total cost at 50% construction grant, with and without the sale of RDF to the BPU at $3,587,500 ($17.40 per ton) and $4,103,700 ($19.90 per ton) and the estimated annual total cost at 100% construction grant, with and without the sale of RDF to the BPU at $1,994,500 ($9.70 per ton) and $2,510,500 ($12.20 per ton).

FIGURE 7-4

ALTERNATIVE B

ENERGY RECOVERY AT JAMESTOWN B.P.U. CARLSON STATION UTILIZING THE PUROX SYSTEM (GASIFIED RDF)



"Direct Haul" processable wastes from southern County to resource recovery refuse receiving area
Daily Average - 223 tons

Direct Haul processable wastes from north-eastern County - Dunkirk area to transfer station.
Daily Average - 127 tons

Transfer Station located near Dunkirk - wastes transferred to resource recovery facility in Jamestown.

Resource recovery facility in Jamestown producing a gaseous RDF; daily input is 350 tons; daily fuel fraction output is 252 tons

Gaseous RDF conveyed from processing plant to Jamestown BPU boilers over a 24 hour period
Daily Average - 252 tons

Resource recovery processing residuals to landfill
Daily Average - 67 tons

Gaseous RDF utilized in Jamestown BPU boilers No. 11 & 12

TABLE 7-7

ALTERNATIVE B

ENERGY RECOVERY AT THE JAMESTOWN BPU
CARLSON STATION UTILIZING THE PUROX SYSTEM
(GASIFIED-RDF)

ESTIMATED PUROX PLANT COSTS
350 TON PER DAY FACILITY
1976

Capital Costs

1.	Purox Plant Facility	$ 13,000,000
2.	Land Acquisition and Site Development	180,000
3.	Refuse Receiving and Handling Facility	485,000
4.	Conveyance of Purox Gas to BPU Facility	500,000
5.	Boiler Modifications	550,000
	Subtotal	$ 14,715,000
6.	Construction Contingency @ 15%	2,207,300
7.	Engineering, Supervision & Admin. @ 15%	2,538,300
	TOTAL	$ 19,460,600

Annual Costs

1.	Debt Service @ 10 years 7%	$ 2,770,800
2.	Coverage @ 15%	415,600
3.	Operating Costs	1,900,000
	TOTAL	$ 5,086,400

Process @ 350 TPD, 282 DPY
98,700 ton per year

Estimated owning and operating cost per ton: $\frac{\$5,086,400}{98,700 \text{ TPY}}$ = \$51.50/ton*

* Excludes Revenue from sale of gasified RDF and 50% construction grant from New York State Department of Environmental Construction.

TABLE 7-8

ALTERNATIVE B

ENERGY RECOVERY AT THE JAMESTOWN BPU CARLSON STATION UTILIZING THE PUROX SYSTEM (GASIFIED-RDF)

COST SUMMARY
1976

		Sale of Gasified-RDF To BPU @ $0.85 per MBTU	No Charge for RDF To BPU
1.	Estimated Capital Cost	$ 19,460,600	$ 19,460,600
2.	50% Construction Grant from New York State D.E.C.	- 9,730,300	- 9,730,300
3.	Capital Cost Local Share	9,730,300	9,730,300
4.	Annual Costs		
	- Debt service @ 7% 10 years	1,385,400	1,385,400
	- Coverage @ 15%	207,800	207,800
	- Operating	1,900,000	1,900,000
	TOTAL	$ 3,493,200	$ 3,493,200
5.	Estimated Annual Potential Revenue @ $0.85 per MBTU	$ - 516,200	$ - 0
6.	Estimated Annual Cost to Operate Including Revenue Credits	$ 2,977,000	$ 3,493,200
7.	Estimated Daily Cost @ 282 DPY	$ 10,560	$ 12,400
8.	Estimated Cost Per Ton (Received) - 350 TPD	$ 30.15	$ 35.40

TABLE 7-9

ALTERNATIVE B

ENERGY RECOVERY AT THE JAMESTOWN BPU CARLSON STATION UTILIZING THE PUROX SYSTEM (GASIFIED-RDF)

PUROX GAS RDF FACILITY COST SUMMARY ASSUMING 100 PERCENT CONSTRUCTION GRANT AVAILABLE

		Sale of Gasified-RDF To BPU @ $0.85 per MBTU	No Charge For RDF To BPU
1.	Estimated Capital Costs	$ 19,460,600	$ 19,460,600
2.	100% Construction Grant	-19,460,600	19,460,600
3.	Capital Cost - Local Share	0	0
4.	Annual Costs:		
	- Debt Service @ 7% 10 years	0	0
	- Coverage @ 15%	0	0
	- Operating	1,900,000	1,900,000
	TOTAL	$ 1,900,000	$ 1,900,000
5.	Estimated Annual Potential Revenue @ $0.85 per BTU	$- 516,200	$- 0
6.	Estimated Annual Cost to Operate including Revenue Credit	$ 1,383,800	$ 1,900,000
7.	Estimated Daily Cost @ 282 DPY	$ 4,900	$ 6,740
8.	Estimated Cost Per Ton (Received) - 350 TPD	$ 14.00	$ 19.25

ALTERNATIVE C-1

ENERGY RECOVERY AT TWO LOCATIONS
(1) SUNY - FREDONIA UTILIZING GASIFIED RDF (PUROX) AND
(2) JAMESTOWN BPU CARLSON STATION
UTILIZING A SOLID-RDF

In this alternative, Chautauqua County's wastes are divided for RDF processing between two potential fuel users. One is the SUNY at Fredonia, in which the northern county's waste would be taken. The other potential RDF fuel user is the Jamestown BPU, which would accommodate the county wastes.

A general flow system diagram of the planned operation is given in Figure 7-5. Since all wastes will be "direct hauled" to the resource recovery facilities, waste transport Scheme III, illustrated in Figure 6-3, is the transport system considered for this alternative. The County would be geographically divided approximately in half, along the line indicated east-west on Figure 6-3 and the wastes would be allocated to the northern or southern portion of the line. The resource recovery location for the northern county wastes of 174 tons per day would be at SUNY, as shown in Figure 7-1. The location of the SUNY with respect to Dunkirk for the resource recovery facility would not significantly alter the waste transport costs. Approximately 211 tons per day of wastes for the southern county area would be "direct hauled" to the Jamestown BPU.

Considering the southern county area for the BPU Carlson Station, 211 tons per day of wastes would be delivered to the resource recovery facility refuse receiving area (refer to Figure 7-3 for general site plan). The refuse would be processed into a solid-RDF during an 8 hour operation and fed into the BPU boilers over a 16 hour period. Since refuse will be received over 8 hours the refuse receiving area should have storage capacity of about 4 hours maximum. If the refuse-receiving area building is about 80' x 50' and refuse-receiving conveyor pits at least 35' x 12' x 10', this will provide approximately 120 tons of storage at a depth of 5 feet for about 4.5 hours. If there is a backup in the refuse processing system, the storage area is critical. Figure 6-9 provides a general layout of such a refuse-receiving facility.

Of the 211 tons per day of wastes to be processed, approximately 158 tons per day will become the solid refined fuel fraction and approximately 53 tons will be processing plant residuals such as ferrous metals, glass, etc. Unless markets for this residual are found, it must be taken to the proposed Busti landfill for disposal. Of the 158 tons of refined fuel fraction, about 79 tons would be fed into the boilers at the BPU over the eight hours during which the processing plant is also operating. The processing plant, although operating only eight hours, will actually prepare all the wastes delivered - 211 tons per day - during that time. The additional RDF of approximately 79 tons will have been processed into a refined fuel fraction and will be stored in a refuse storage silo for RFF. The refuse storage silo will be conical in shape and should provide a little more than eight hours of storage capacity of processed refined fuel fraction to be fed into the BPU boilers over the following eight hours, at an average rate of approximately 10 tons per hour RFF. Converting the feed rate of 10 tons per hour of RFF over 16 hours into steam, this results in the supplemental firing to produce approximately 85,000 pph of steam for 16 hours. Referring to Table 3-11, the average daily generated load is 27,900 KWH or about 305,000 pph of steam over 24 hours. Comparing the supplemental firing capability of the wastes to the average daily generated load, approximately 28 percent would be generated from RFF use. If the RFF were fed into the boilers at the above rate only during the RDF eight hour processing plant operation (since there is limited storage capacity in the refuse storage silo for approximately 80 tons of RFF) assuming an average steam load at the BPU station, supplemental RFF firing would make up about 28 percent of the steam fuel requirements. Since the approximate remaining 79 tons per day of RFF is stored in the refuse storage silo, it would be fed into the boilers over the remaining 16 hours rather than eight hours. This would lower the percentage of supplemental waste firing at average load to approximately 14 percent.

The resource recovery system that would be utilized to process the incoming 211 tons of wastes into a refined fuel fraction is the same system described in Chapter 5, as illustrated in Figure 5-2. The refined fuel fraction consists of combustible waste material at 6,630 BTU per pound, 15 percent moisture for a 75% RFF.

The northern county wastes would be taken to the boiler plant area of the SUNY Campus at Fredonia, where a gaseous refuse-derived fuel processing plant would be built. (The boilers at SUNY are gas fired and cannot use a solid RDF) Refer to Figure 7-6 for a general site plan of the facilities layout. The gasification system considered is the Purox System as described in Chapter 5, with the system flow chart illustrated in Figure 5-4.

Wastes would be transported to the waste receiving area by waste transport Scheme III, as outlined in Chapter 6, Figure 6-3. 174 tons per day of wastes from the northern county area are "direct hauled" to the proposed SUNY - Purox waste receiving area. Figure 6-9 illustrates a typical resource recovery processing plant waste receiving area. The Purox system would operate on a 24 hour basis, therefore since wastes would be received over eight hours, sufficient storage at the waste receiving area will be desirable. At an hourly feed rate of about 7.3 tons, storage would be required for approximately 115 tons of unprocessed wastes. With a waste receiving area similar in size to the previously discussed alternative for the Jamestown BPU (receiving building approximately 80' x 50' and waste receiving pits 35' x 12' x 10'), a total storage capacity of approximately 120 tons would exist at a depth of 5 feet.

ESTIMATED COSTS

Table 7-10 provides the estimated capital cost for both the SUNY Purox system and the Jamestown BPU Solid RDF system. As can be seen, there are only slight reductions in costs, as compared to the 350 and 385 ton per day systems. This is due in part to the fact that cost increment decreases are not significant when only a small reduction in size capacity of process machinery occurs. The Purox system capital cost was not reduced at all due to a smaller throughput of wastes, since the Purox units are not currently manufactured any smaller than the 350 TPD module unit. This may change in the future and could result in a lower capital investment. It is noted that the 350 ton per day Purox Module has a throughput guarantee of 80 percent, or 280 tons per day (87,360 tons per year) including all down time. A 30 day "down time" period per year has been allocated, as well as only a 6 day per week, operation, resulting in approximately 12 percent above the manufacturers guarantee, or 98,700 tons per year.

Table 7-11 is a cost summary of both systems with the 50% NPDEC construction grant included, and also assuming that a 100% construction grant is possible.

Examining the estimate individual systems capital and operating costs after potential revenues are included, the solid RDF system is significantly less costly than the Purox gas System ($9.50 per ton versus $57.60 per ton). Revenues from the sale of Purox gas to the SUNY boiler facility were developed from the monthly SUNY Campus Report on energy consumption. The current fuel cost per million BTU of natural gas to SUNY was used in the July, 1975 report, $1.65 per MBTU. Assuming that SUNY would pay 75% of their current fuel cost for the Purox gas, the value of the gas is therefore $1.24 per MBTU. Annually, this translates, at 174 tons per day 282 days per year, to $319,200.

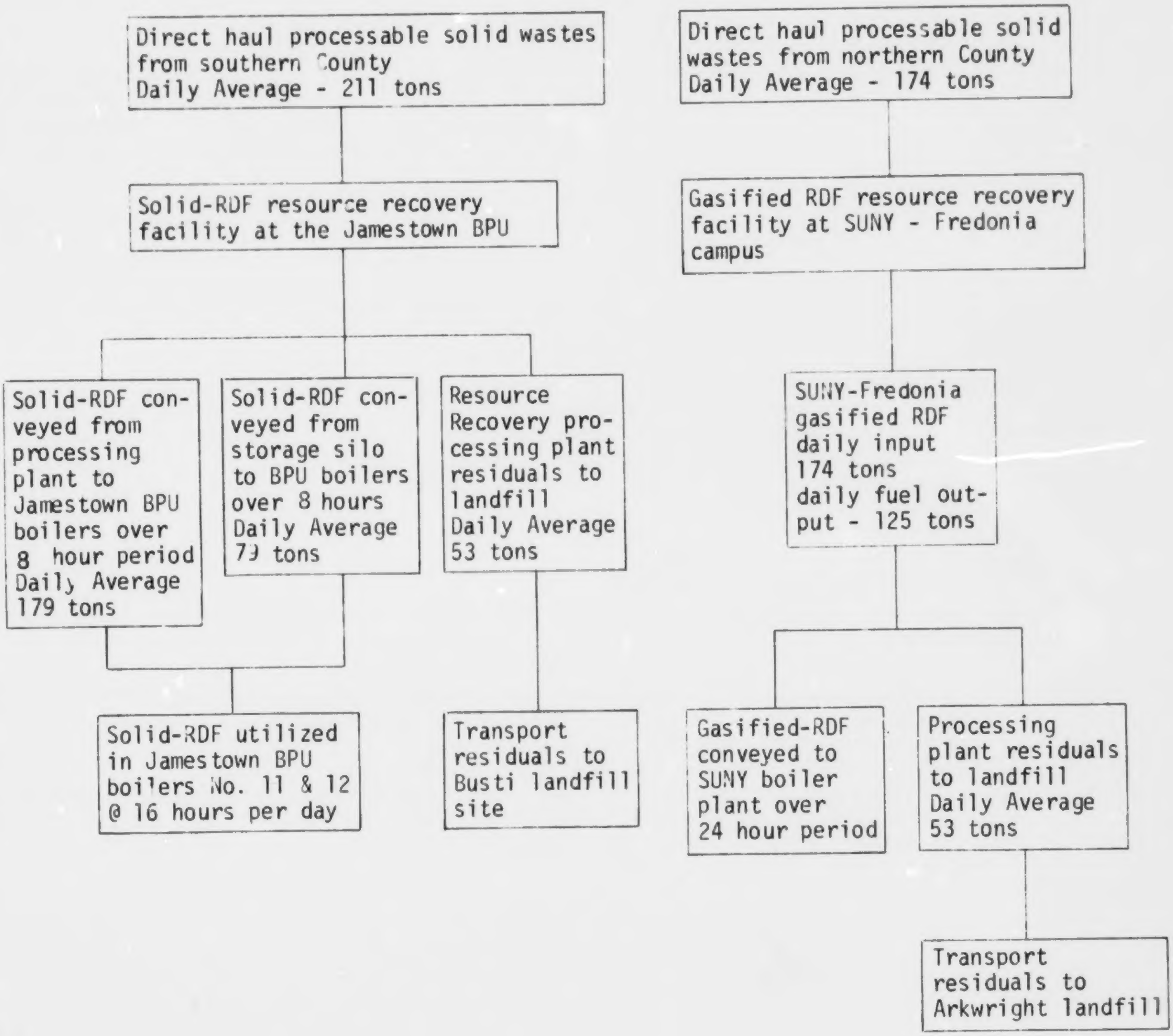
The combined gas-solid RDF system operating cost per ton yields $31.30. If a 100 percent construction grant were provided for the Purox-SUNY installation only and the normal 50% construction grant to the BPU, the combined system total operating cost per ton would be $17.20.

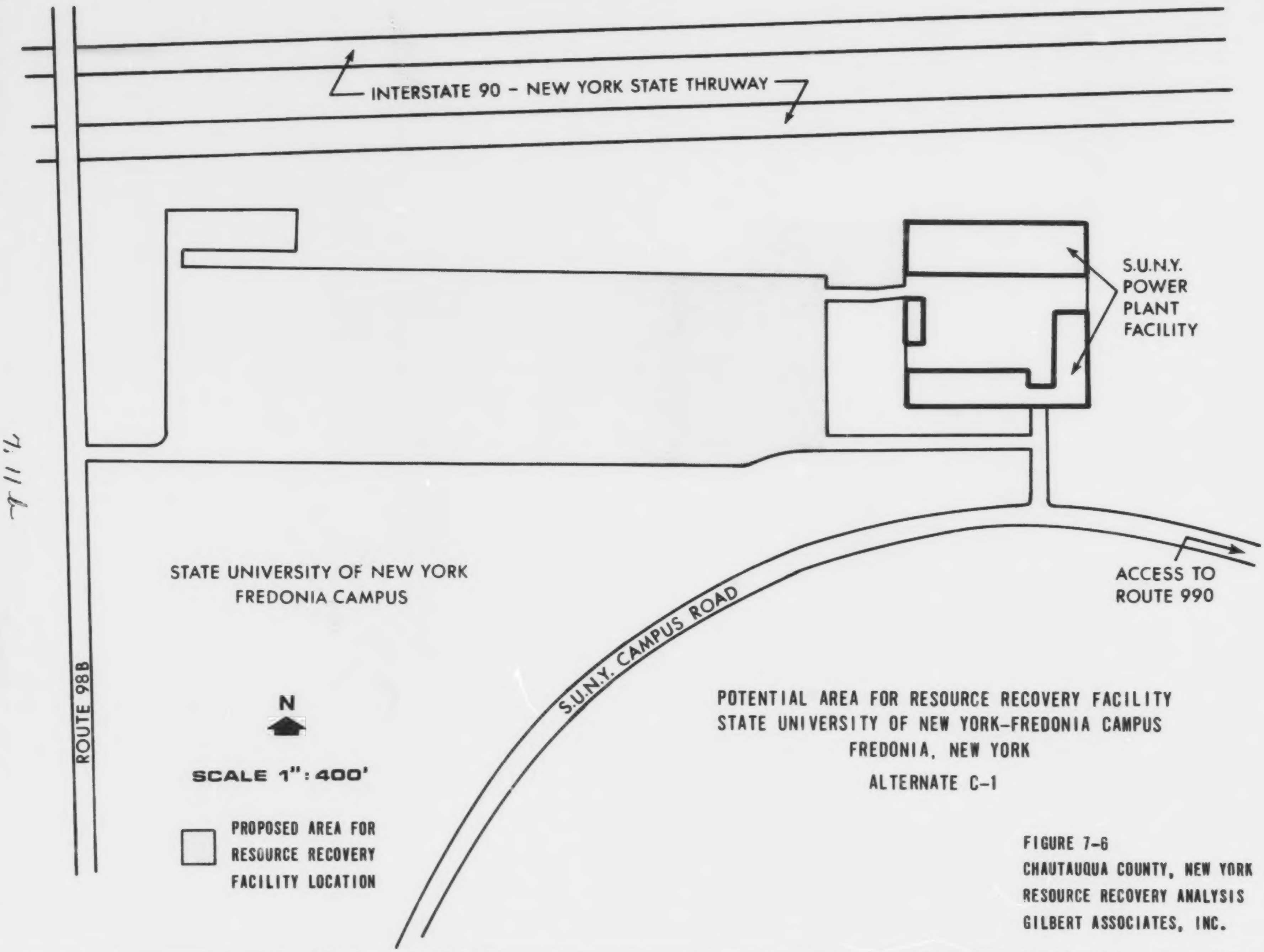
Table 7-27 provides a total system cost summary for Alternative C-1. The estimated total annual cost of all components of Alternative C-1, assuming a 50% construction grant for both systems is $3,754,100 or $18.20 per ton of wastes generated county-wide, compared with $2,228,400 or $10.80 per ton generated with a 100% construction grant for the SUNY Purox system and 50% construction grant for BPU were available. If it is felt that this alternative is economically attractive, the SUNY Construction Fund could contribute the remaining 50% of the construction monies (in addition to the 50% by the N.Y.D.E.C.) to obtain the 100% construction grant for the Purox system at SUNY. However, when compared with other Alternative costs, Alternative C-1 does not look favorable from an economic standpoint.

FIGURE 7-5

ALTERNATIVE C-1

ENERGY RECOVERY AT TWO LOCATIONS: (1) SUNY-FREDONIA UTILIZING A GASIFIED - RDF (PUROX) & (2) JAMESTOWN BPU CARLSON STATION


Direct haul processable solid wastes from southern County Daily Average - 211 tons
Solid-RDF resource recovery facility at the Jamestown BPU
Solid-RDF conveyed from processing plant to Jamestown BPU boilers over 8 hour period Daily Average 179 tons
Solid-RDF conveyed from storage silo to BPU boilers over 8 hours Daily Average 79 tons
Resource Recovery processing plant residuals to landfill Daily Average 53 tons
Solid-RDF utilized in Jamestown BPU boilers No. 11 & 12 @ 16 hours per day
Transport residuals to Busti landfill site
Direct haul processable solid wastes from northern County Daily Average - 174 tons
Gasified RDF resource recovery facility at SUNY - Fredonia campus
SUNY-Fredonia gasified RDF daily input 174 tons daily fuel output - 125 tons
Gasified-RDF conveyed to SUNY boiler plant over 24 hour period
Processing plant residuals to landfill Daily Average 53 tons
Transport residuals to Arkwright landfill


INTERSTATE 90 – NEW YORK STATE THRUWAY
S.U.N.Y. POWER PLANT FACILITY
ROUTE 98B
STATE UNIVERSITY OF NEW YORK FREDONIA CAMPUS
S.U.N.Y. CAMPUS ROAD
ACCESS TO ROUTE 990
N
SCALE 1": 400'
PROPOSED AREA FOR RESOURCE RECOVERY FACILITY LOCATION

POTENTIAL AREA FOR RESOURCE RECOVERY FACILITY
STATE UNIVERSITY OF NEW YORK–FREDONIA CAMPUS
FREDONIA, NEW YORK
ALTERNATE C–1

FIGURE 7–6
CHAUTAUQUA COUNTY, NEW YORK
RESOURCE RECOVERY ANALYSIS
GILBERT ASSOCIATES, INC.

TABLE 7-10

ALTERNATIVE C-1

ENERGY RECOVERY AT TWO LOCATIONS:
(1) SUNY-FREDONIA UTILIZING GASIFIED-RDF (PUROX)
(2) JAMESTOWN BPU CARLSON STATION UTILIZING A SOLID-RDF

ESTIMATED CAPITAL COSTS
1976

CAPITAL COSTS

I.	SUNY - Purox System		
1.	Purox Plant Facility	$13,000,000	
2.	Land acquisition and site development	100,000	
3.	Refuse receiving and handling facility	365,000	
4.	Conveyance of Purox Gas to SUNY Boilers	75,000	
5.	Boiler modifications	550,000	
	Subtotal	$14,091,000	
6.	Construction Contingency @ 15%	2,113,700	
7.	Engineering, Supervision & Admin. @ 15%	2,430,700	
	Subtotal		$18,635,400
II.	Jamestown BPU Solid RDF System		
1.	Building, land, site preparation, electrical, utilities, scale, etc.	$ 1,192,000	
2.	Processing Plant Equipment installed	1,744,000	
3.	Refuse Receiving Area	340,000	
4.	Boiler modifications	550,000	
	Subtotal	$ 3,826,000	
5.	Construction Contingency @ 15%	573,900	
6.	Engineering, Supervision & Admin. @ 15%	660,000	
	Subtotal		$ 5,059,900
	ESTIMATED TOTAL COMBINED CAPITAL COST		$23,695,300

TABLE 7-11

ALTERNATIVE C-1

ENERGY RECOVERY AT TWO LOCATIONS:
(1) SUNY-FREDONIA UTILIZING GASIFIED-RDF (PUROX)
(2) JAMESTOWN BPU CARLSON STATION UTILIZING A SOLID-RDF

TOTAL COST SUMMARY

	SUNY Purox Gas System @ 174 TPD	Jamestown BPU Solid RDF System @ 211 TPD	Both Systems combined @ 385 TPD	Both Systems combined assuming 100% construction grant for Purox System at SUNY @ 385 TPD
1. Estimated Capital Cost	$18,635,400	$ 5,059,900	$23,695,300	$23,695,300
2. 50% Construction Grant from New York State D.E.C.	-9,317,700	-2,530,000	-11,847,700	-21,165,400
3. Capital Cost Local Share	$ 9,317,700	$ 2,530,000	$11,847,700	$ 2,530,000
4. Annual Costs				
- Debt Service @ 7% 10 years	$ 1,326,700	$ 360,200	$ 1,686,900	$ 360,200
- Coverage @ 15%	199,000	54,000	253,000	54,000
- Operating	1,620,000	565,000	2,185,000	2,185,000
TOTAL	$ 3,145,700	$ 979,200	$ 4,124,900	$ 2,599,200
5. Estimated Annual Potential Revenue	-$ 319,200[1]	-$ 411,700[2]	$ 730,900	-$ 730,900
6. Estimated Annual Cost to Operate Including Revenue Credits	$ 2,826,500	$ 567,500	$ 3,394,900	$ 1,868,300
7. Estimated Daily Cost @ 282 DPY	$ 10,000	$ 2,010	$ 12,040	$ 6,625
8. Estimated Cost Per Ton (Received)	$ 57.60	$ 9.50	$ 31.30	$ 17.20

(1) SUNY Gas Cost @ $1.65/MBTU 75% yields $1.24/MBTU
(2) BPU Coal Cost @ $1.13/MBTU 75% yields $0.85/MBTU

ALTERNATIVE C-2

ENERGY RECOVERY AT TWO LOCATIONS:
(1) CUMMINS ENGINE COMPANY AND
(2) JAMESTOWN BPU CARLSON STATION
UTILIZING A SOLID RDF

For this Alternative, the processable refined RDF is divided between two potential fuel users. One is the Cummins Engine Company and the other is the Jamestown BPU. Both would utilize a solid RDF, prepared at a processing facility located near the BPU generating station, since the BPU would be using approximately 75 percent of the total refined fuel fraction of the wastes. In general, the overall system would require wastes to be transferred from the Dunkirk area via Waste Transport Scheme I, as illustrated in Figure 6-1. The same logistics for transporting and receiving the wastes would apply as previously described for the BPU in Alternative A. The waste receiving area at the processing plant in Jamestown, as well as the transfer station in Dunkirk, would all be similar, as described in Alternative A. Referring to the schematic of system operation, Figure 7-7, approximately 285 tons per day of processable wastes will be "direct hauled" to the waste receiving area at the processing plant, with 127 tons per day transfer hauled to the processing plant from Dunkirk. The processing facility will process 385 tons of wastes into 287 tons per day of RFF over 16 hours.

Average daily load demand at the BPU represents 305,000 pph steam over 24 hours. Cummins Engine Company daily average load is projected to be 80,000 pph steam over 24 hours by 1980. (Cummins Engine Company currently does not have the capability to accept a solid-RDF; however, a new boiler plant is planned for the future, which could be designed to accept a refuse derived fuel as a supplement to coal.)

For consideration of this alternative, it is assumed that the BPU will accept 25 percent of RDF as a coal supplement, and Cummins Engine Company will accept about 33 percent RDF. (Since Cummins Engine Company has not built the boilers that they will be using in 1980, they could, in fact, be designed to accommodate a higher percentage of RDF than 33 percent, if Cummins should desire to do so. There are currently waste-fired boilers utilizing 100 percent RDF, i.e., Hamilton, Ontario, Canada. The final RDF quantity to be utilized by Cummins and BPU can be determined in the future, if this alternative is selected and implemented.)

With the BPU utilizing a 25 percent RDF fuel supplement over 24 hours, approximately 76,300 pph steam would be generated by the 213 ton per day of RDF (8.9 tons per hour).

Cummins would be utilizing approximately 74 tons of RDF, capable of producing 26,500 pph steam over 24 hours (3.1 tons per hour of RDF), resulting in a 33 percent supplemental RDF firing.

Since the RDF will be utilized over a 24-hour period and the processing plant will be operating over 16 hours per day, RDF storage will be necessary at both fuel user sites. The RDF storage silo at the BPU should be capable of storing at least 71 tons of RDF, since about 142 tons of RDF will be utilized over the 16 hour period when the processing plant is in operation. The remaining RDF stored (71 tons) will be fed to the boilers over the remaining hours of the day.

For the Cummins Engine Company, RDF would be transferred from the processing facility via transfer trailer to the Cummins storage silo, where it would be fed to the boilers at an hour rate of approximately 3.1 tons. The RDF would be transferred to the Cummins storage silo over an eight hour period. Therefore, since approximately 24 tons will be utilized during the eight hours of RDF transfer, approximately 50 tons of RDF will require storage for use throughout the remaining 16 hours of the day. The storage silo would require approximately half the storage capacity of the BPU RDF silo.

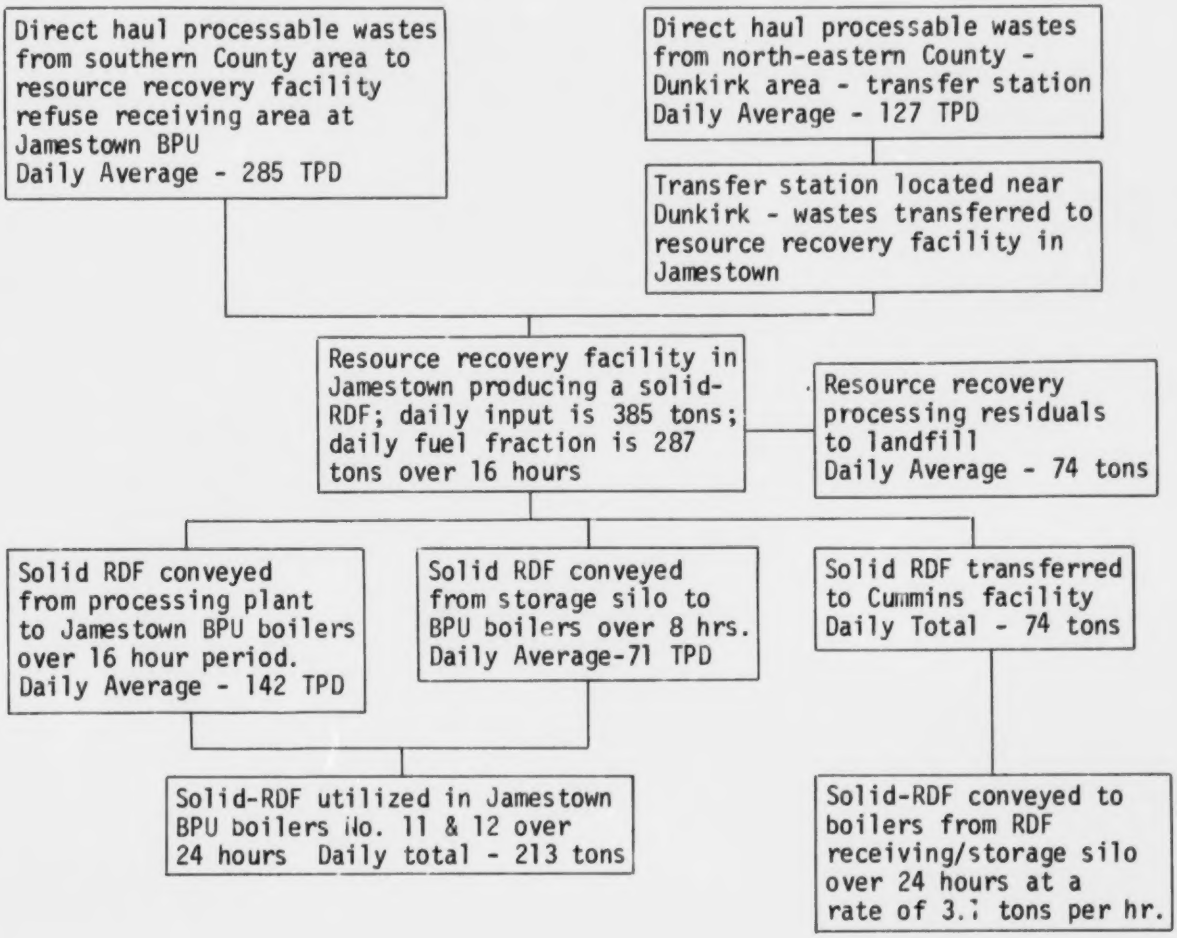
The estimated capital costs of the Jamestown BPU and Cummins facilities are given in Table 7-12, yielding a combined total of $6,970,900. The estimated annual operating costs are provided in Table 7-13, yielded a combined annual operating cost of $1,039,200, excluding owning costs and RDF fuel user charges. Table 7-14 provides a total estimated cost summary, including the 50 percent NTSDEC construction grant annual owning costs, and estimated revenue from the sale of RDF. The estimated annual operating cost is $861,000 or $7.90 per ton.

Table 7-27 provides a Total System Cost Summary of Alternative C-2, including the estimated Direct County Waste transport cost, the transfer station at $287,600, the estimated cost to landfill wastes not accepted at the recovery facility at $343,200, the estimated annual landfill cost savings by utilizing the wastes as a fuel at $69,000, the estimated credit for sale of RDF at $749,000, and the estimated annual total cost to the county at $1,422,800 or $6.90 per ton.

FIGURE 7-7

ALTERNATIVE C-2

ENERGY RECOVERY AT TWO LOCATIONS: (1) CUMMINS ENGINE COMPANY* AND (2) JAMESTOWN BPU CARLSON STATION UTILIZING A SOLID RDF



Direct haul processable wastes from southern County area to resource recovery facility refuse receiving area at Jamestown BPU
Daily Average - 285 TPD

Direct haul processable wastes from north-eastern County - Dunkirk area - transfer station
Daily Average - 127 TPD

Transfer station located near Dunkirk - wastes transferred to resource recovery facility in Jamestown

Resource recovery facility in Jamestown producing a solid-RDF; daily input is 385 tons; daily fuel fraction is 287 tons over 16 hours

Resource recovery processing residuals to landfill
Daily Average - 74 tons

Solid RDF conveyed from processing plant to Jamestown BPU boilers over 16 hour period.
Daily Average - 142 TPD

Solid RDF conveyed from storage silo to BPU boilers over 8 hrs.
Daily Average-71 TPD

Solid RDF transferred to Cummins facility
Daily Total - 74 tons

Solid-RDF utilized in Jamestown BPU boilers No. 11 & 12 over 24 hours Daily total - 213 tons

Solid-RDF conveyed to boilers from RDF receiving/storage silo over 24 hours at a rate of 3.1 tons per hr.

* Considered viable only if plant process load is increased to 80,000 pph @ 24 hours and new boilers to be installed can accommodate a solid RDF

POTENTIAL AREA FOR RESOURCE RECOVERY FACILITY
CUMMINS ENGINE COMPANY
LAKEWOOD, NEW YORK
(BUSTI TOWNSHIP)

ALTERNATIVE C-2

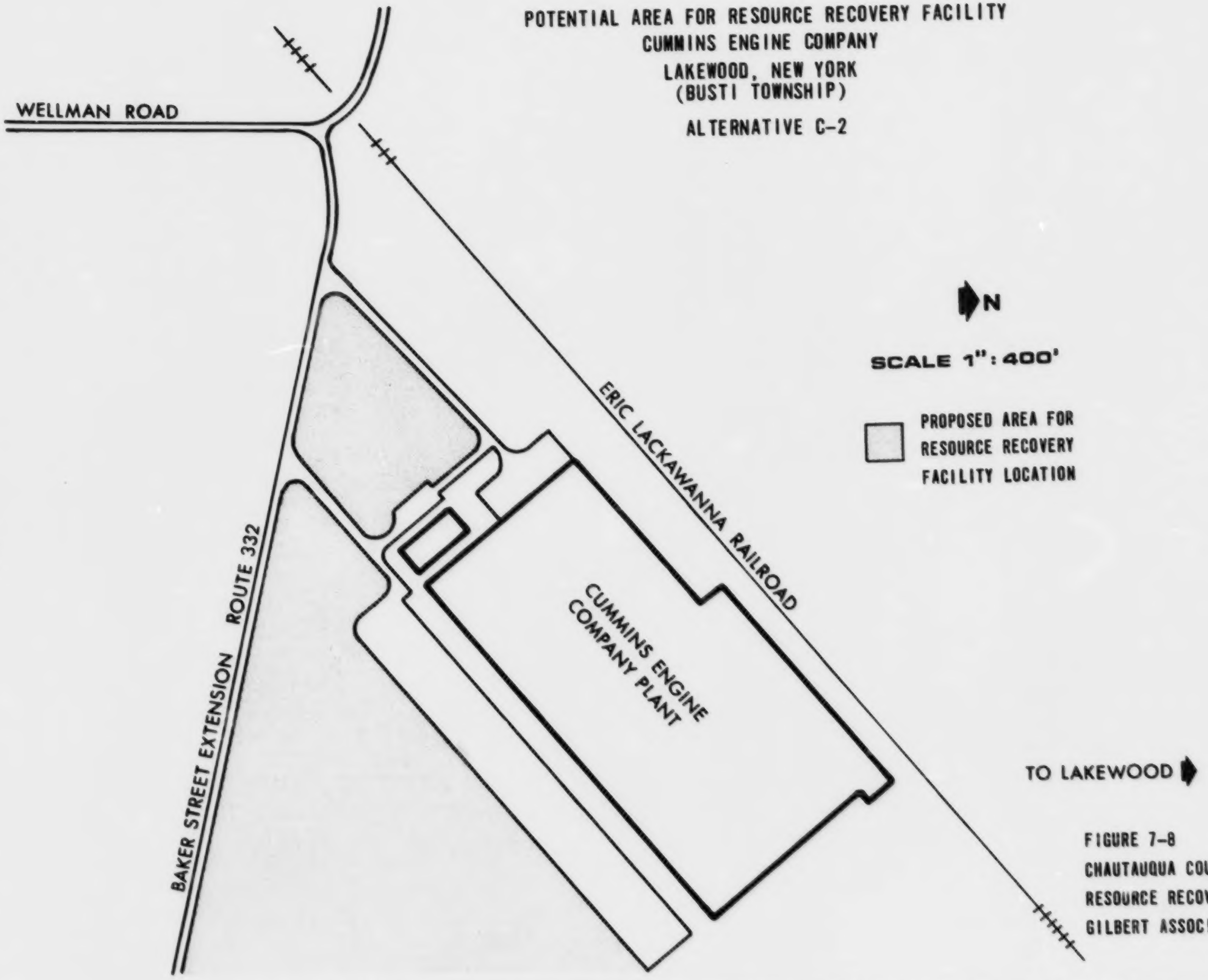

WELLMAN ROAD
ERIC LACKAWANNA RAILROAD
N
SCALE 1": 400'
PROPOSED AREA FOR RESOURCE RECOVERY FACILITY LOCATION
CUMMINS ENGINE COMPANY PLANT
BAKER STREET EXTENSION
ROUTE 332
TO LAKEWOOD

FIGURE 7-8
CHAUTAUQUA COUNTY, NEW YORI
RESOURCE RECOVERY ANALYSIS
GILBERT ASSOCIATES, INC.

TABLE 7-12

ALTERNATIVE C-2

ENERGY RECOVERY AT TWO LOCATIONS:
(1) CUMMINS ENGINE COMPANY AND
(2) JAMESTOWN BPU CARLSON STATION
UTILIZING A SOLID RDF

ESTIMATED CAPITAL COSTS
1976

I.	Cummins Engine Company Facility		
1.	Land acquisition and site development	$ 100,000	
2.	Refuse receiving, handling, and storage facilities	575,000	
3.	Conveyance of solid RDF to boilers	120,000	
4.	Boiler modifications	550,000	
	Subtotal	$ 1,345,000	
5.	Construction Contingency @ 15%	201,800	
6.	Engineering Supervision & Administration @ 15%	232,000	
	Subtotal		$ 1,778,800
II.	Jamestown BPU Facility with Resource Recovery Facility		
1.	Building, land, site preparation, utilities, scale, etc.	$ 1,192,000	
2.	Processing Plant Equipment installed	1,744,000	
3.	Refuse Receiving Area	340,000	
4.	RDF transfer for facility to Cummins	100,000	
5.	Boiler modifications	550,000	
	Subtotal	$ 3,926,000	
6.	Construction Contingency @ 15%	588,900	
7.	Engineering, Supervision & Administration @ 15%	677,200	
	Subtotal		$ 5,192,100
	ESTIMATED TOTAL COMBINED CAPITAL COST		$ 6,970,900

7,13-c

TABLE 7-13

ALTERNATIVE C-2

ENERGY RECOVERY AT TWO LOCATIONS: (1) CUMMINS ENGINE COMPANY AND (2) JAMESTOWN BPU CARLSON STATION UTILIZING A SOLID RDF

ANNUAL ESTIMATED OPERATING COSTS 1976

I.	Cummins Engine Company		
	1.	Labor 3 personnel for one 8-hour shift, including benefits	$ 44,600
	2.	Maintenance, Repair and Utilities	65,000
	3.	RDF transport cost from BPU	14,400
	4.	Tractor and trailer @ 6% for 5 years	20,000
	5.	Tractor/trailer sinking fund @ 5.5%, 5 years	15,000
		SUBTOTAL	$ 159,000
II.	Jamestown BPU/Resource Recovery Facility		
	1.	Labor - 11 personnel for two 8-hour shifts/day - 6 days/week	$ 300,000
		35% allowance - benefits, overtime	105,000
		SUBTOTAL	$ 405,000
	2.	Maintenance & Repair - Parts replacement, etc. Facility-Building, etc.	$ 10,000
		Equipment	180,000
		SUBTOTAL	$ 190,000
	3.	Heating, Water, and Miscellaneous Supplies	$ 20,000
	4.	Fuel, Maintenance & Repair Front End Loader, Residual Hauling Truck and Containers	$ 40,000
	5.	Electric Power	$ 120,000
	6.	Processing Facility Residue Disposal Costs	$ 89,100
	7.	Sinking Fund for Residue Haul Truck and Containers @ 5.5% for 5 years ($90,000)	$ 16,000
		SUBTOTAL	$ 880,200
		TOTAL ANNUAL ESTIMATED COMBINED SYSTEM OPERATING COSTS	$ 1,039,200

TABLE 7-14

ALTERNATIVE C-2

ENERGY RECOVERY AT TWO LOCATIONS:
(1) CUMMINS ENGINE COMPANY AND
(2) JAMESTOWN BPU CARLSON STATION
UTILIZING A SOLID RDF

TOTAL COST SUMMARY WITH NYDEC CONSTRUCTION GRANT
1976

		Jamestown BPU and Cummins Engine Company @ 385 TPD
1.	Estimated Capital Cost	$ 6,970,900
2.	50% Construction Grant from NYDEC	$ 3,485,500
3.	Capital Cost Local Share	$ 3,485,500
4.	Annual Costs	
	- Debt Service @ 7% 10 years	$ 496,300
	- Coverage @ 15%	74,500
	- Operating	1,039,200
	TOTAL	$ 1,610,000 ($14.80 per ton)
5.	Estimated Annual Potential Revenue (1)	-$ 749,000
6.	Estimated Annual Cost to Operate, including Revenue Credits	$ 861,000
7.	Estimated Daily Cost @ 282 DPY	$ 3,050
8.	Estimated Cost per ton Received - (385 TPD)	$ 7.90

(1) Assuming BPU/Cummins Coal Cost @ $1.13/MBTU and yield 75% @ $0.85/MBTU

ALTERNATIVE D-1

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA AND ERIE COUNTIES

This alternative involves the concept of processing Erie County wastes for utilization as a solid-RDF at the Dunkirk Power Station. This involvement stems from a similar resource recovery study currently underway for Erie County, in which wastes will be processed into RDF and transfer-hauled by trailer to the Niagara-Mohawk Dunkirk power station for use as a supplementary fuel.

The Niagara-Mohawk Power Company was contacted by telephone concerning a feasibility study that they were conducting involving wastes principally from Erie, Niagara and Chautauqua counties. It was Niagara-Mohawk's intention that all four boiler units at the Dunkirk Power station would be considered for modification to accept an RDF from the Tri-County area. The processing plant for the production of an RDF would be in Erie County. The Consultant performing the study for Erie County was also contacted (Horner and Shifrin). The Consultant indicated that the four units at the Dunkirk station were being examined for conversion to a solid RDF combined firing, 16 hours per day for 6 days per week.[a] Currently between 1230 and 1850 tons per day of unprocessed wastes are being considered for the Dunkirk station. Gasification was investigated; however due to the innovative nature of the processes available, lack of operating experience with utility boilers and energy efficiency loss converting the processable wastes to a gas, the consultant did not consider gasification very promising at this time.

Two options were discussed concerning utilizing the Dunkirk station in conjunction with Chautauqua County/Erie County wastes: (1) Chautauqua County construct its own processing facility and deliver processed RDF to the Dunkirk station, along with delivered Erie County RDF; (2) Chautauqua County utilizing the Erie County Processing Processing Plant for RDF, by loading the empty transfer trailers going back to Erie County from the Dunkirk station, with unprocessed Chautauqua County wastes. These wastes would then be processed by Erie County into RDF. The consultant considered the first option preferable, because there could be a problem at the Erie County processing plant in handling the additional Chautauqua County's 385 tons per day of processable wastes, as outlined in the second option. Also there could be political problems concerning the transport of unprocessed wastes across county lines as well as the anticipated 79 tons per day of anticipated residuals from processing the Chautauqua County wastes. The Erie County consultant did not however rule out the idea of Erie County processing the wastes from Chautauqua County, but felt that if Chautauqua County would construct its own processing plant, the combining of the Erie and Chautauqua County RDF at the Dunkirk station would probably be easier to implement. One potential problem could arise with the Dunkirk station, in that Chautauqua County could produce approximately 287 tons of RDF daily at a 75 percent refined fuel fraction (RFF). (The same 75 percent RFF is planned for Erie County RDF.) With the planned Erie County RDF coming to the Dunkirk station, utilizing Chautauqua County RDF could raise the percentage of supplemental RDF firing higher than originally desired. This however, may be workable since Chautauqua County's RDF tonnage is small compared to the Erie County RDF tonnage. To summarize, both the Consultant and the Niagara-Mohawk Power Company saw no insurmountable obstacles to incorporating processable wastes from Chautauqua County into their waste plan. Future discussions will have to take place between the counties of Chautauqua and Erie and the Niagara-Mohawk Power Company to work out details of combining the county systems.

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[a] The C.R. Huntley Power Plant near Buffalo was also included in their evaluation, however this power plant would not impact on the Chautauqua County waste utilization.

Included in Appendix J is the summary and conclusions from The Niagara-Mohawk Power Corporation Appraisal of the Use of Solid Waste as a Supplementary Fuel at the Huntley and Dunkirk Stations. The impact of the summary and conclusions of the Niagara Mohawk feasibility study will be discussed in greater detail in the section for Alternative E. However their effect on this alternative D-1 has two possibilities. Either the supplemental waste fuel firing rates be increased at both the Dunkirk and Huntley Stations to 20% (so that all Niagara, Erie and Chautauqua County wastes be accommodated) or porations of waste from Erie, Chautauqua and or Niagara counties not be included in the recovery system. It is probable that a combination of both suggestions could ultimately be worked out between the tri-county region. This could be accomplished by lowering the supplemental firing rate somewhere between 15-20 percent and landfilling the excess wastes, either by excluding certain municipalities, collection districts or even one of the three counties from the resource recovery system. It will require nevertheless, approximately a 20% supplemental waste fuel firing rate for all three counties to participate fully.

It will be necessary for some type of multi-county arrangement to be made with the Niagara-Mohawk Power Corporation for this Alternative (D-1) to be considered feasible for implementation consideration.

The schematic plan of this alternative is presented in Figure 7-9. The object of this alternative is to have all processable wastes in Chautauqua County, 385 tons, brought to a Chautauqua County resource recovery processing facility in Dunkirk, located near the Niagara-Mohawk Dunkirk station. Here the Chautauqua County wastes would be processed into a 75% refined fuel fraction and transported to the Dunkirk Power Station for use as a fuel supplement in conjunction with the Erie County RDF unloading station. The raw wastes from Chautauqua and Erie Counties will be processed to approximately a 75% refined fuel fraction (the same as the estimated design output of the solid-RDF facility for Chautauqua County as shown in Figure 5-2.)

For this alternative, wastes are transported via waste transport Scheme II - one resource recovery facility in Dunkirk with a transfer station in Jamestown. Although waste transport Scheme II is estimated to be more costly to the County than waste transport Scheme V (Refer to Table 6-1), it is felt that the convenience of having the transfer station near

Jamestown would lessen the potential problem of collection vehicle turnaround time at the processing plant in Dunkirk, and scheduling of collection routes with a long haul distance to Dunkirk that would probably occur with direct haul to Dunkirk.

The county is divided into northern and southern waste districts along an east-west line, with the communities below the line, shown in Figure 6-3, taking their wastes to the Jamestown transfer station and the northern communities direct hauling their wastes to the resource recovery facility in Dunkirk.

Approximately 211 tons per day would be transferred to the resource recovery facility in Dunkirk from Jamestown. Approximately 174 tons per day would be "direct hauled" from the northern communities to the resource recovery facility in Dunkirk. The resource recovery facility would operate over an eight-hour period per day, processing wastes as they are delivered. The waste receiving area of the processing facility would be similar to the one illustrated in Figure 6-9, with a building of approximately 110' x 80' and two refuse receiving conveyor pits each 45' x 12' x 10'. This provides a potential storage capacity of waste material, piled 5 feet high, of approximately 260 tons. This translates to about 3.3 hours at the daily maximum hourly waste load flow of 80 TPH, or 6 hours storage at the average waste flow of 45 TPH. (Maximum and hourly waste flows were determined from the two-week field weighing survey.) At 18 tons per trailer payload, it will require 12 trips daily to transport the 211 tons per day of wastes delivered to the Jamestown transfer station.

The resource recovery processing plant, as mentioned previously, is the same type of processing plant as described in Chapter 5 for solid refuse derived fuel production. The daily refined fuel output is approximately 287 tons per day RFF, with about 79 tons of processing plant residuals to be landfilled at the proposed Arkwright landfill site, if markets for these materials are not found. The 287 tons of RFF is equivalent to approximately 2,450,000 pounds of steam per day. This translates to approximately 306,000 pound of steam per hour over an eight-hour period. According to the field survey summary, Table 3-10, the daily year-round load for all four boilers at the Dunkirk Plant is 3,070,000 pounds of steam per hour. This means that all of Chautauqua County's waste could supply the Dunkirk plant with slightly less than 10 percent of the entire average load for eight hours of the day, or less than 5 percent for 16 hours. It will be less of a contribution if the flow is spread out over additional hours or if the average load demand at the power plant is increased.

The processed refined fuel fraction from the Dunkirk resource recovery facility could either be transported via transfer trailer to the plant, or if a suitable land area located close enough to the Dunkirk Power Station is found, the RFF could be pneumatically conveyed, eliminating the need for additional transfer trailers. For the analysis presented here, it is assumed that a site will be found for the resource recovery processing plant near enough to the Dunkirk Power Station to convey the refined fuel fraction pneumatically. A general site plan is presented in Figure 7-10.

Cost Estimates

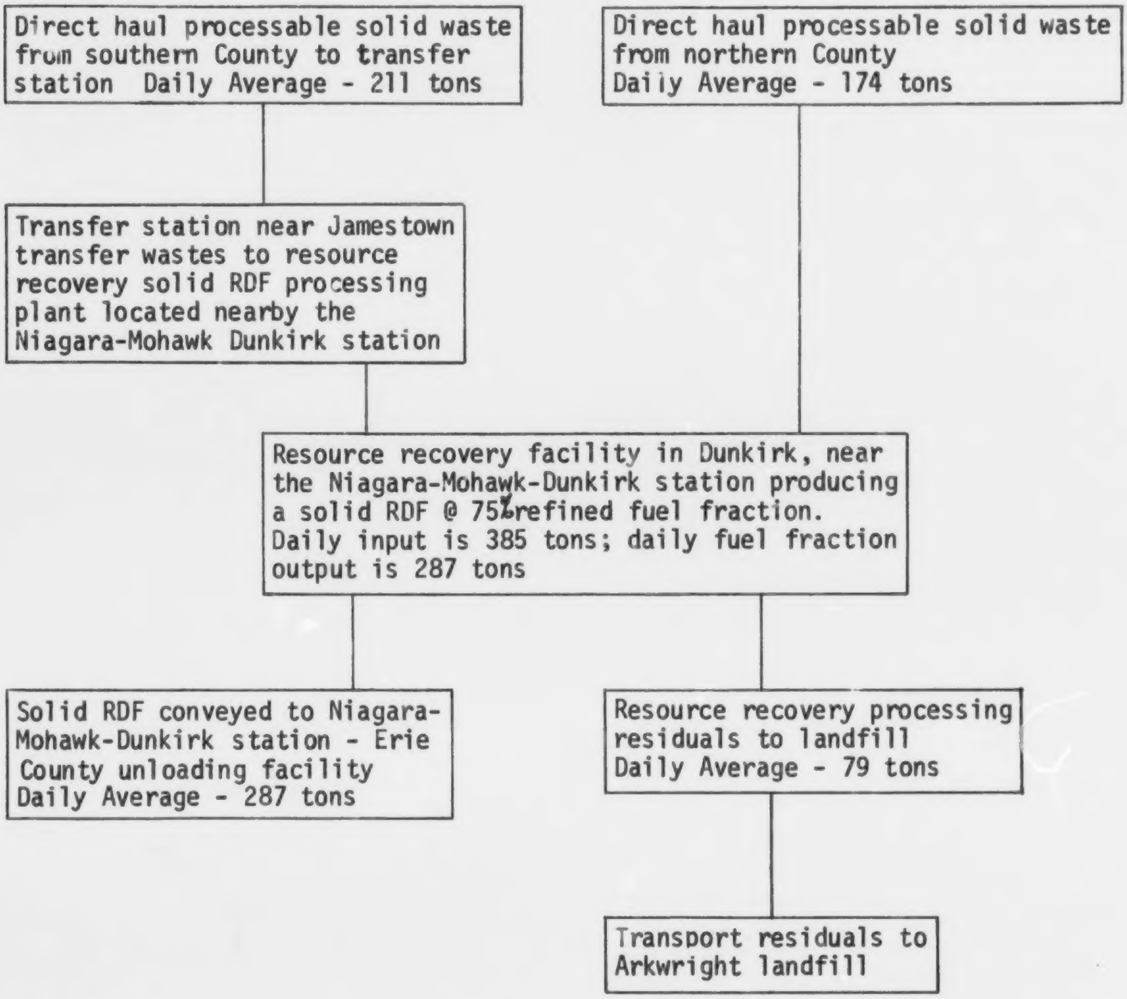
Capital costs of the proposed resource recovery processing facility are given in Table 7-15. It is assumed that the boiler modifications will not be part of Chautauqua County's cost, therefore no charge is allocated. The estimated capital cost is $4,182,000. Estimated annual plant operating costs are given in Table 7-16, totaling $613,700. The estimated cost to pay for and operate the resource recovery facility without fuel credit revenues or New York State Department of Environmental Construction Grant is $12.00 per ton, Table 7-17. The total cost summary (Table 7-18) includes the 50% construction grant and assumes revenues from Niagara-Mohawk for the purchase of the RFF (at 75% of existing fuel costs assumed to be $1.13 per MBTU or $0.85 per MBTU). The estimated cost to amortize and operate the recovery facility with the 50% construction grant and no revenues from RDF sale is $8.80 per ton received. When revenues are included for the sale of RDF, the capital and operating cost per ton is lowered to $1.90.

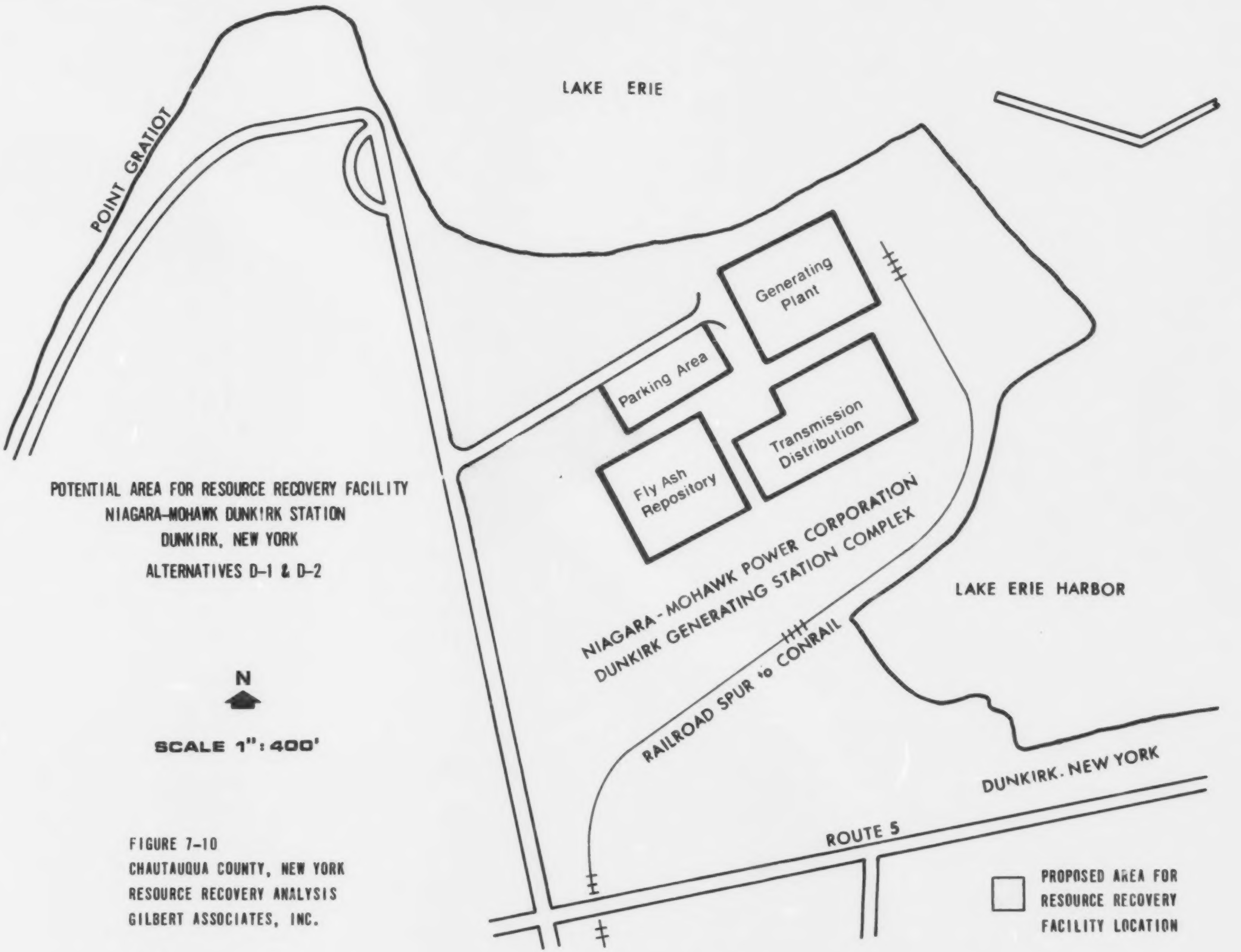
Table 7-27 provides a summary of Alternative D-1 annual total system costs, including estimated Direct County Waste Transport Costs at $384,300, estimated landfill costs of wastes not accepted at the recovery facility at $343,000, estimated landfill cost savings by utilizing the RDF instead of landfilling at $69,000 and the estimated revenue from the sale of RDF at $749,000. The total system annual cost per ton is estimated at $865,600 or $4.20 per ton.

FIGURE 7-9

ALTERNATIVE D-1

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA AND ERIE COUNTIES


Direct haul processable solid waste from southern County to transfer station Daily Average - 211 tons
Direct haul processable solid waste from northern County Daily Average - 174 tons
Transfer station near Jamestown transfer wastes to resource recovery solid RDF processing plant located nearby the Niagara-Mohawk Dunkirk station
Resource recovery facility in Dunkirk, near the Niagara-Mohawk-Dunkirk station producing a solid RDF @ 75% refined fuel fraction. Daily input is 385 tons; daily fuel fraction output is 287 tons
Solid RDF conveyed to Niagara-Mohawk-Dunkirk station - Erie County unloading facility Daily Average - 287 tons
Resource recovery processing residuals to landfill Daily Average - 79 tons
Transport residuals to Arkwright landfill



LAKE ERIE
POINT GRATIOT
Generating Plant
Parking Area
Transmission Distribution
Fly Ash Repository
NIAGARA - MOHAWK POWER CORPORATION
DUNKIRK GENERATING STATION COMPLEX
RAILROAD SPUR to CONRAIL
LAKE ERIE HARBOR
DUNKIRK, NEW YORK
ROUTE 5
PROPOSED AREA FOR RESOURCE RECOVERY FACILITY LOCATION
N

POTENTIAL AREA FOR RESOURCE RECOVERY FACILITY
NIAGARA-MOHAWK DUNKIRK STATION
DUNKIRK, NEW YORK
ALTERNATIVES D-1 & D-2

SCALE 1":400'

FIGURE 7-10
CHAUTAUQUA COUNTY, NEW YORK
RESOURCE RECOVERY ANALYSIS
GILBERT ASSOCIATES, INC.

TABLE 7-15

ALTERNATIVE D-1

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUATAUQUA AND ERIE COUNTIES

CAPITAL COST ESTIMATE
RESOURCE RECOVERY FACILITY IN DUNKIRK
385 TONS PER DAY
1976

PROCESSING/RECOVERY PLANT

I. Building

1.	Land Acquisition	$ 60,000
2.	Site Preparation, Grading, etc.	120,000
3.	Building, foundations, scale	662,000
4.	Electrical	280,000
5.	Utilities, plumbing, etc.	70,000
	Sub-total	$ 1,192,000

II. Processing Equipment - Installed

1.	Primary Shredder with feed and take away oscillating conveyor	425,000
2.	Intermediate Conveyors - Into and Out of Trommel	94,000
3.	Magnetic Separator	65,000
4.	Trommel	125,000
5.	Second Stage Shredder	190,000
6.	Allowance for pneumatic feed and surge storage	600,000
7.	Dust Control System	85,000
	Sub-total	$ 1,584,000

III. Refuse Receiving and Handling Facility

1.	Receiving Waste Pit Conveyors and cross feed conveyor	125,000
2.	Construction of Refuse Receiving Pit and associated accessories	50,000
3.	Transportation truck for roll on/roll off containers	55,000
4.	Two 40 C.Y. roll on/roll off open top waste containers for Processing Plant residuals	14,000
5.	Three 40 C.Y. roll on/roll off open top waste containers. Two for auto delivered wastes plus one spare	21,000
6.	Front end loader and accessories	120,000
	Sub-total	$ 385,000

TABLE 7-15 (Cont'd)

ALTERNATIVE D-1

CAPITAL COST ESTIMATE

IV. Boiler Modifications

Sub-Total	$ 0
Sub-total Item I, II, III & IV	$ 3,161,000
Construction Contingency - 15%	475,000
Engineering, Supervision & Administration 15% of total	546,000
TOTAL	$ 4,182,000

TABLE 7-16

ALTERNATIVE D-1

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUATAUQUA AND ERIE COUNTIES

ESTIMATED ANNUAL RESOURCE RECOVERY FACILITY OPERATING COSTS

385 TPD - SIX DAYS/WEEK
1976

1.	Labor - 11 personnel for one eight hour shift/day - 6 days/week	$ 150,000
	35% allowance - benefits, overtime	53,000
	Sub-total	$ 203,500
2.	Maintenance & Repair - parts replacement etc.	
	Facility-Building etc.	$ 10,000
	Equipment	135,000
	Sub-total	$ 145,000
3.	Heating, Water and Miscellaneous Supplies	$ 20,000
4.	Fuel, Maintenance and Repair Front End Loader, Residual Hauling Truck and Containers	$ 40,000
5.	Electric Power	$ 100,000
6.	Processing Facility Residue Disposal Costs	$ 89,100
7.	Sinking fund for Residue Haul Truck and Containers @ 5.5% for 5 years ($90,000)	$ 16,100
	Total Annual Estimated Plant Operating Costs	$ 613,700

* 282 operating days per year

TABLE 7-17

ALTERNATIVE D-1

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUATAUQUA AND ERIE COUNTIES

ESTIMATED COST PER TON OF REFUSE PROCESSED TO OWN AND OPERATE RESOURCE RECOVERY FACILITY IN DUNKIRK
1976

			Annual Cost
1.	Estimated Total Capital Cost Amortized @ 10 years 7% ($4,182,000)		$ 595,400
2.	Coverage @ 15% ($595,400)		89,300
3.	Estimated Annual Operating Cost		613,700
		TOTAL	$ 1,298,400

Estimated Average Annual Refuse Processed in 1985-385 TPD @ 282 operating days per year yields 108,570 tons per year

Estimated Cost Per Ton to pay for and Operate Resource Recovery Facility $\frac{\$1,298,400}{108,570 \text{ TPY}}$ = $12.00/ton*

* Excludes Revenue from sale of RDF and 50% Construction Grant from New York State Department of Environmental Construction.

TABLE 7-18

ALTERNATIVE D-1

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUATAUQUA AND ERIE COUNTIES

RESOURCE RECOVERY SOLID RDF PROCESSING FACILITY AT DUNKIRK TOTAL COST SUMMARY WITH NYDEC CONSTRUCTION GRANT

1976

		Solid RDF Facility @ 385 TPD
1.	Estimated Capital Cost	$ 4,182,000
2.	50% Construction Grant from New York State D.E.C.	-2,091,000
3.	Capital Cost Local Share	2,091,000
4.	Annual Costs	
	- Debt Service @ 7% 10 years	297,700
	- Coverage @ 15%	44,700
	- Operating	613,700
	TOTAL	$ 956,100 ($8.80 per ton)
5.	Estimated Annual Potential Revenue @ $0.85 per MBTU (1)	$ 749,000
6.	Estimated Annual Cost to Operate Including Revenue Credits	$ 207,100
7.	Estimated Daily Cost @ 282 DPY	$ 735
8.	Estimated Cost Per Ton (Received - 385 tons)	$ 1.90

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(1) Assuming that Niagara-Mohawk would pay 75% of current fuel costs assumed at $1.13 per MBTU.

ALTERNATIVE D-2

ENERGY RECOVERY AT NIAGARA-MOHAWK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA COUNTY ONLY

This alternative involves the same Scheme (waste transport processing facility in Chautauqua County and fuel user Niagara-Mohawk Dunkirk Station) as described previously in Alternative D-1. The difference is that RDF from Erie County is not considered. The reason is that should the Dunkirk Power Station not be utilized for RDF burning or if the proposed plan is not implemented by Niagara-Mohawk (Appendix J) Chautauqua County could approach Niagara-Mohawk with the proposal to implement the use of RDF burning at the Dunkirk station. Referring to Figure 7-11, wastes would be transfer hauled from Jamestown to a RDF processing plant in Dunkirk, located close to the Dunkirk Power Station. All wastes would be processed in an eight-hour day and be utilized by the Dunkirk Station in the same eight-hour period. Chautauqua County would construct a resource recovery processing facility to manufacture the RDF. Referring to Table 3-10, if the two smaller boilers are converted to accept the RDF, with average load demands at 515,000 pph steam each, the total daily load demand is estimated at 1,030,000 pph. The 287 tons per day of RDF could supply, over an 8 hour period, about 306,000 pph steam (102,000 pph steam if utilized over 24 hours). This would result in a 30 percent RDF utilization over eight hours. Provision has been made in the financing for a RDF storage silo to accommodate up to 70 tons of RFF, which would lessen the RDF input, if spread out of additional hours. (12 hours RDF utilization per day would result in 204,000 pph steam or approximately 20 percent RDF supplemental input.)

The general site plan of the processing facility would be the same as indicated in Figure 7-10.

Cost Estimates

The capital cost of the proposed resource recovery facility, $5,130,000, is shown on Table 7-19. Included therein are estimated costs for boiler modifications and RDF conveyance and storage. The estimated annual operating cost is given in Table 7-20. The estimated total annual costs, before RDF sale or construction grant, are $1,453,700 or $13.40 per ton, Table 7-21. The cost summary, Table 7-22 includes a 50 percent construction grant from the NYDEC and the RDF credits resulting in an estimated annual operating cost of $284,700 or $2.60 per ton.

Table 7-27 provides a total system annual cost summary for Alternative D-2, including the estimated Direct County Waste Transport Cost at $384,300, estimated landfill costs of wastes not accepted at the recovery facility at $343,000, estimated landfill cost savings by utilizing the RDF instead of landfilling at $69,000, and estimated revenue from the sale of RDF at $749,000. The total annual cost per ton is estimated at $943,200 or $4.60 per ton.

FIGURE 7-11

ALTERNATIVE D-2

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA COUNTY ONLY

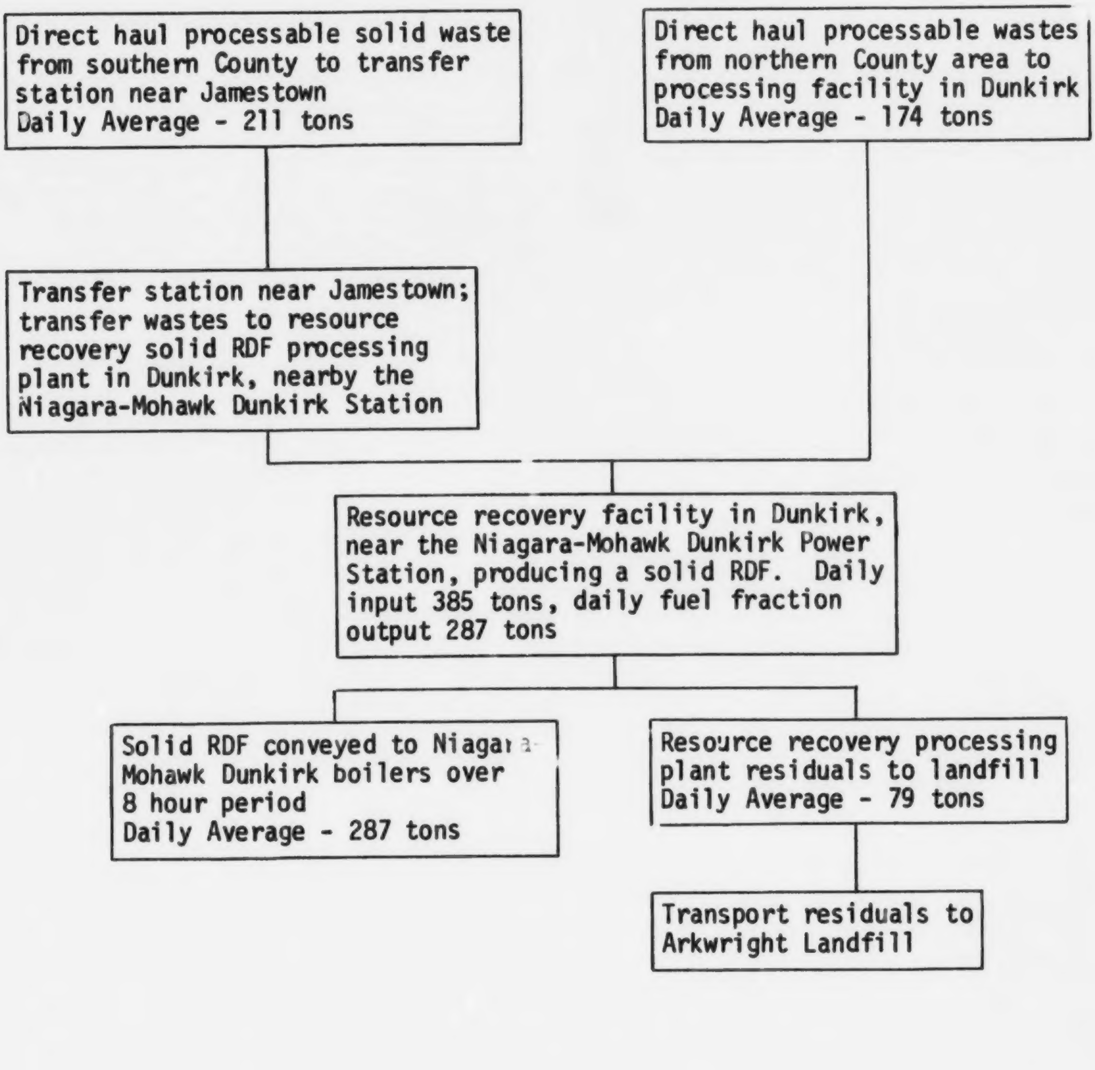

Direct haul processable solid waste from southern County to transfer station near Jamestown Daily Average - 211 tons
Direct haul processable wastes from northern County area to processing facility in Dunkirk Daily Average - 174 tons
Transfer station near Jamestown; transfer wastes to resource recovery solid RDF processing plant in Dunkirk, nearby the Niagara-Mohawk Dunkirk Station
Resource recovery facility in Dunkirk, near the Niagara-Mohawk Dunkirk Power Station, producing a solid RDF. Daily input 385 tons, daily fuel fraction output 287 tons
Solid RDF conveyed to Niagara-Mohawk Dunkirk boilers over 8 hour period Daily Average - 287 tons
Resource recovery processing plant residuals to landfill Daily Average - 79 tons
Transport residuals to Arkwright Landfill

TABLE 7-19

ALTERNATIVE D-2

ENERGY RECOVERY AT NIAGARA-MOHAWK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA COUNTY ONLY

CAPITAL COST ESTIMATE
RESOURCE RECOVERY FACILITY
385 TONS PER DAY
1976

PROCESSING/RECOVERY PLANT

I. BUILDING

1.	Land Acquisition		$ 60,000
2.	Site Preparation, Grading, etc.		120,000
3.	Building, foundations, scale		662,000
4.	Electrical		280,000
5.	Utilities, plumbing, etc.		70,000
		Subtotal	$1,192,000

II. Processing Equipment - Installed

1.	Primary Shredder w/feed & take away oscillating conveyor		425,000
2.	Intermediate Conveyors - Into and Out of Trommel		94,000
3.	Magnetic Separator		65,000
4.	Trommel		125,000
5.	Second Stage Shredder		190,000
6.	Allowance for pneumatic feed		260,000
7.	Refuse Storage Silo		500,000
8.	Dust Control System		85,000
		Subtotal	$1,744,000

III. Refuse Receiving and Handling Facility

1.	Receiving Waste Pit Conveyors and cross feed conveyor		125,000
2.	Construction of Refuse Receiving Pit and associated accessories		50,000
3.	Transportation truck for roll on/roll off containers		55,000
4.	Two 40 C.Y. roll on/roll off open top waste containers for Processing Plant residuals		14,000
5.	Three 40 C.Y. roll on/roll off open top waste containers. Two for auto delivered wastes plus one spare		21,000
6.	Front end loader and accessories		120,000
		Subtotal	$ 385,000

TABLE 7-19 (Cont'd)

CAPITAL COST ESTIMATE

IV. Boiler Modifications	Subtotal	$ 550,000
Subtotal Item I, II, III & IV		3,871,000
Construction Contingency - 15%		581,000
Engineering, Supervision & Admin. 15% of total		678,000
	TOTAL	$5,130,000

TABLE 7-20

ALTERNATIVE D-2

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA COUNTY ONLY

ESTIMATED ANNUAL RESOURCE RECOVERY FACILITY OPERATING COSTS
385 TPD - SIX DAYS/WEEK*
1976

1.	Labor - 11 personnel for one eight hour shift/day - 6 days/week	$150,500
	35% allowance - benefits, overtime	53,000
	Subtotal	$203,500
2.	Maintenance & Repair - parts replacement etc.	
	Facility-Building etc.	$ 10,000
	Equipment	135,000
	Subtotal	$145,000
3.	Heating, Water, and Miscellaneous Supplies	$ 20,000
4.	Fuel, Maintenance & Repair Front End Loader, Residual Hauling Truck and Containers	$ 40,000
5.	Electric Power	$100,000
6.	Processing Facility Residue Disposal Costs	$ 89,100
7.	Sinking fund for Residue Haul Truck and Containers @ 5.5% for 5 years ($90,000)	$ 16,100
	Total Annual Estimated Plant Operating Costs	$613,700

TABLE 7-21

ALTERNATIVE D-2

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA COUNTY ONLY

ESTIMATED COST PER TON OF REFUSE PROCESSED TO OWN AND OPERATE RESOURCE RECOVERY FACILITY
1976

			Annual Cost
1.	Estimated Total Debt Service @ 10 years 7% ($5,130,000)		$ 730,400
2.	Coverage @ 15% ($730,400)		109,600
3.	Estimated Annual Operating Cost		613,700
		TOTAL	$1,453,700

Estimated Average Annual Refuse Processed in 1985-385 TPD @ 282 operating days per year yields 108,570 tons per year

Estimated Cost Per Ton to Pay for and Operate Resource Recovery Facility $\frac{\$1,453,700}{108,570\ \text{TPY}}$ = $13.40/ton*

* Excludes revenue from the sale of RDF and the 50% Construction Grant from the NYDEC.

TABLE 7-22

ALTERNATIVE D-2

ENERGY RECOVERY AT NIAGARA-MOHAWK DUNKIRK POWER STATION UTILIZING A SOLID RDF FROM CHAUTAUQUA COUNTY ONLY

RESOURCE RECOVERY SOLID RDF PROCESSING FACILITY AT DUNKIRK TOTAL COST SUMMARY WITH NYDEC CONSTRUCTION GRANT

1976

		Solid RDF Facility @ 385 TPD
1.	Estimated Capital Cost	$ 5,130,000
2.	50% Construction Grant from New York State D.E.C.	-2,565,000
3.	Capital Cost: Local Share	2,565,000
4.	Annual Costs	
	- Debt Service @ 7% 10 years	365,200
	- Coverage @ 15%	54,800
	- Operating	613,700
	TOTAL	$ 1,033,700 ($9.50 per ton)
5.	Estimated Annual Potential Revenue @ $0.85 per MBTU(1)	$ 749,000
6.	Estimated Annual Cost to Operate Including Revenue Credits	$ 284,700
7.	Estimated Daily Cost @ 282 DPY	$ 1,010
8.	Estimated Cost Per Ton (Received - 385 tons)	$ 2.60

---

(1) Assuming that Niagara-Mohawk would pay 75% of their current fuel costs assumed at $1.13 per MBTU.

ALTERNATIVE E

TRANSFER CHAUTAUQUA COUNTY PROCESSABLE WASTES TO ERIE COUNTY RESOURCE RECOVERY FACILITY FOR PROCESSING INTO A SOLID RDF

The concept described in this alternative was prompted by conversations with the Niagara-Mohawk Power Corporation and their consultant. The concept involved is an inter-county cooperative effort. For an outline of the approach, refer to the schematic general system plan in Figure 7-12. Two transfer stations would be built, one in Jamestown to accommodate approximately 211 tons per day of wastes and one in Dunkirk that would handle approximately 174 tons per day. Wastes would be "direct hauled" to each transfer station by the Waste Transport Scheme III, illustrated in Figure 6-3. Instead of hauling wastes in Chautauqua County to resource recovery processing plants, however, wastes will be taken to a transfer station. Figure 7-13 illustrates the transfer station concept and provides a general location for it.

Wastes from the Jamestown transfer station will be transferred in trailers to the Dunkirk transfer station and the trailers parked in a designated area. Twelve trailer load trips per day will be required to transfer the wastes from Jamestown to Dunkirk. At the Dunkirk transfer station incoming wastes will also be packed into transfer trailers.

While this is happening, processed refuse-derived fuel from an Erie County processing facility is being hauled to the Dunkirk Power Station in loaded transfer trailers for use as a supplemental fuel. After these transfer trailers empty their load of RDF at the Dunkirk Power Station, they would normally be driven back to Erie County empty to pick up another load of RDF.

A possible solution to processing the wastes into RDF and obtaining a long-term fuel user for Chautauqua County wastes would be to join and become a part of the Erie County-Niagara Mohawk RDF system in the following manner. Since the Erie County System will use transfer trailers that return empty to the Erie County Processing Plant after unloading RDF at the Dunkirk Power Station, the Chautauqua County Dunkirk transfer station could be located conveniently on the Erie County transfer trailer route to and from the Dunkirk Power Station. Upon return to Erie County from the Dunkirk Power Station, the trucks could stop at the Chautauqua County Dunkirk transfer station and exchange an empty trailer for a fully loaded transfer trailer. The loaded transfer trailer would then be hauled to the Erie County waste processing facility and emptied, where the unprocessed Chautauqua County wastes would be turned into refuse-derived fuel for use at the Dunkirk Power Station. The empty transfer trailer left at the Dunkirk transfer station would be put into service either at Dunkirk or hauled to Jamestown for use at that transfer station. Meanwhile, the processed Chautauqua/Erie County refuse derived fuel would be loaded into the now-empty transfer trailer that was used to haul unprocessed Chautauqua County wastes to Erie County for processing. The RDF filled transfer trailer would then be hauled to the Dunkirk Power Station for dumping. On the way back to Erie County the empty transfer trailer is exchanged for a loaded trailer and the cycle starts again.

Approximately 22 trailer loads of Chautauqua County wastes would be taken to Erie County for processing, six days per week at approximately 18 tons per load. Since the transfer trailers are assumed to stop at least once an hour, at the transfer station, only four transfer trailers are required for Jamestown and 2 transfer trailers for Dunkirk, with empty trailers available throughout the 8-hour transfer day in Chautauqua County. The system is illustrated in Figure 7-13.

System Costs

The costs associated with this transfer station system are (1) capital and operating cost of two transfer stations, and (2) haul cost of transferred wastes from Jamestown to Dunkirk and then to Erie County for processing. Table 7-23 provides the estimated Capital Cost for the two transfer stations in Jamestown and Dunkirk and associated transport equipment at $1,097,000. The estimated annual operating cost excluding debt service is also given at $249,700 and the annual waste transport costs are $129,100. A detailed cost summary of transfer station and associated transport equipment costs is given in Appendix I. The total estimated annual cost including a 25 percent NYSDEC construction grant for transfer stations and debt service is $366,400 or $3.40 per ton, Table 7-24. A total cost summary of Alternative E is given in Table 7-27, including the estimated annual operating cost at $366,400, estimated Direct County Waste Transport Cost at $129,100 which includes the cost for trailers one way to Erie County, estimated cost to landfill wastes not processable at the recovery facility at $343,300, estimated landfill cost savings by utilizing wastes as energy instead of landfilling at $69,000 and the total estimated annual cost at $769,700 or $3.75 per ton. Any potential revenue from the sale of RDF was not included because it cannot be determined at this time. Also, any charge Erie County-Niagara Mohawk might place on Chautauqua County was not given in the Cost Summary. These factors will be discussed further.

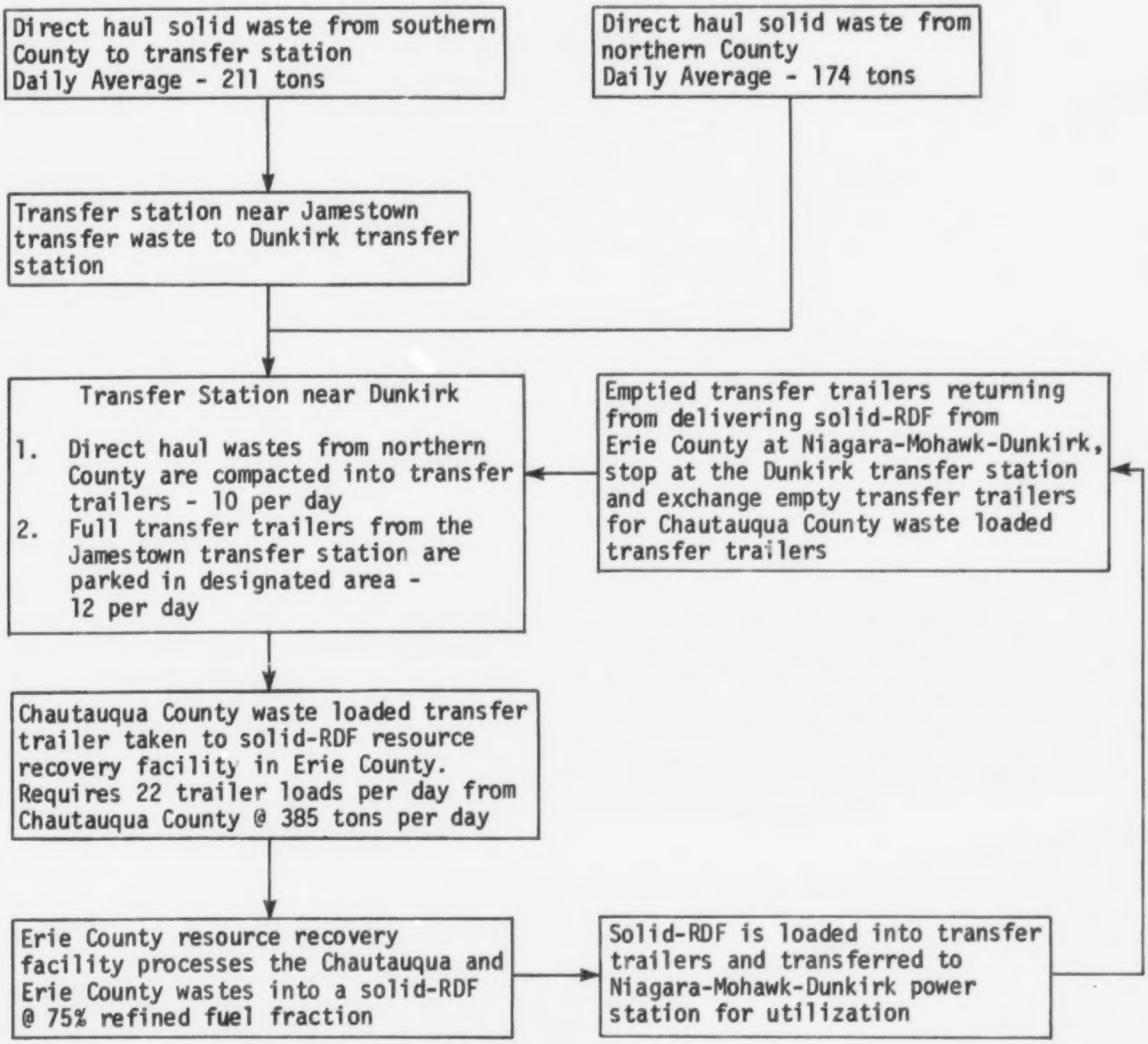
Probable Additional Costs

The cost of processing the Chautauqua County wastes in the Erie County-Niagara Mohawk resource recovery system must also be considered, as must also the costs of disposing of the associated residual. However, the wastes transferred to Erie County do have an associated fuel value. Assuming $0.85 per MBTU, the 385 tons per day of unprocessed Chautauqua County waste will provide an estimated annual revenue of $749,000 or $6.90 per ton of unprocessed Chautauqua County Waste (in terms of refined fuel fraction, 287 tons per day of Chautauqua County RDF is $9.25 per ton RDF). With the New York State Department of Environmental Construction grant of 50%, the cost to Chautauqua County to process all its own waste without including credits is approximately $8.90 per ton. (Refer to Alternative D-2, Table 7-22.) Larger processing facilities should be much

FIGURE 7-12

ALTERNATIVE E

TRANSFER CHAUTAUQUA COUNTY PROCESSABLE WASTES TO THE ERIE COUNTY RESOURCE RECOVERY FACILITY FOR PROCESSING INTO A SOLID-RDF



Direct haul solid waste from southern County to transfer station
Daily Average - 211 tons

Direct haul solid waste from northern County
Daily Average - 174 tons

Transfer station near Jamestown transfer waste to Dunkirk transfer station

Transfer Station near Dunkirk

1. Direct haul wastes from northern County are compacted into transfer trailers - 10 per day
2. Full transfer trailers from the Jamestown transfer station are parked in designated area - 12 per day

Emptied transfer trailers returning from delivering solid-RDF from Erie County at Niagara-Mohawk-Dunkirk, stop at the Dunkirk transfer station and exchange empty transfer trailers for Chautauqua County waste loaded transfer trailers

Chautauqua County waste loaded transfer trailer taken to solid-RDF resource recovery facility in Erie County. Requires 22 trailer loads per day from Chautauqua County @ 385 tons per day

Erie County resource recovery facility processes the Chautauqua and Erie County wastes into a solid-RDF @ 75% refined fuel fraction

Solid-RDF is loaded into transfer trailers and transferred to Niagara-Mohawk-Dunkirk power station for utilization

TABLE 7-23

ALTERNATIVE E

TRANSFER CHAUTAUQUA COUNTY PROCESSABLE WASTES TO ERIE COUNTY RESOURCE RECOVERY FACILITY FOR PROCESSING INTO A SOLID RDF

ESTIMATED COSTS[a]

1. ESTIMATED CAPITAL COSTS		
A. Dunkirk		
- Transfer Station		$ 366,000
- Trailers (2)		54,000
	Subtotal	$ 420,000
B. Jamestown		
- Transfer Station		$ 479,000
- Tractors (3)		90,000
- Trailers (4)		108,000
	Subtotal	$ 677,000
TOTAL CAPITAL COSTS		$1,097,000
2. ESTIMATED ANNUAL OPERATING COSTS[b]		
A. Dunkirk		
- Transfer Station		$ 77,500
- Trailers (2), including Sinking Fund		9,500
	Subtotal	$ 87,000
B. Jamestown		
- Transfer Station		$ 79,200
- Tractors (3), including Sinking Fund		64,200
- Trailers (4), including Sinking Fund		19,300
	Subtotal	$ 162,700
TOTAL ANNUAL OPERATING COSTS		$ 249,700
3. ESTIMATED ANNUAL WASTE TRANSPORT COSTS		
A. Dunkirk		
- Trailers one way to Erie County		$ 14,200
B. Jamestown		
- Tractors from Jamestown to Dunkirk		$ 70,900
- Trailers from Jamestown to Dunkirk		27,000
- Trailers one way to Erie County		17,000
TOTAL ANNUAL WASTE TRANSPORT COSTS		$ 129,100

(a) Refer to Appendix I
(b) Does not include debt service costs.

TABLE 7-24

ALTERNATIVE E

TRANSFER CHAUTAUQUA COUNTY PROCESSABLE WASTES TO ERIE COUNTY RESOURCE RECOVERY FACILITY FOR PROCESSING INTO A SOLID RDF

TOTAL COST SUMMARY WITH NYSDEC CONSTRUCTION GRANT

			Transfer Station System @ 385 Tons Per Day
1.	Estimated Capital Cost		$1,097,000
2.	25% Construction Grant from New York State D.E.C.		$ 274,250
3.	Capital Cost Local County Share		$ 822,750
4.	Annual Costs		
	- Debt Service @ 7% 10 years		$ 117,200
	- Operating		249,700
		Total	$ 366,900
5.	Estimated Daily Cost @ 282 DPY		$ 1,300
6.	Estimated Cost Per Ton (Received - 385 TPD)		$ 3.40

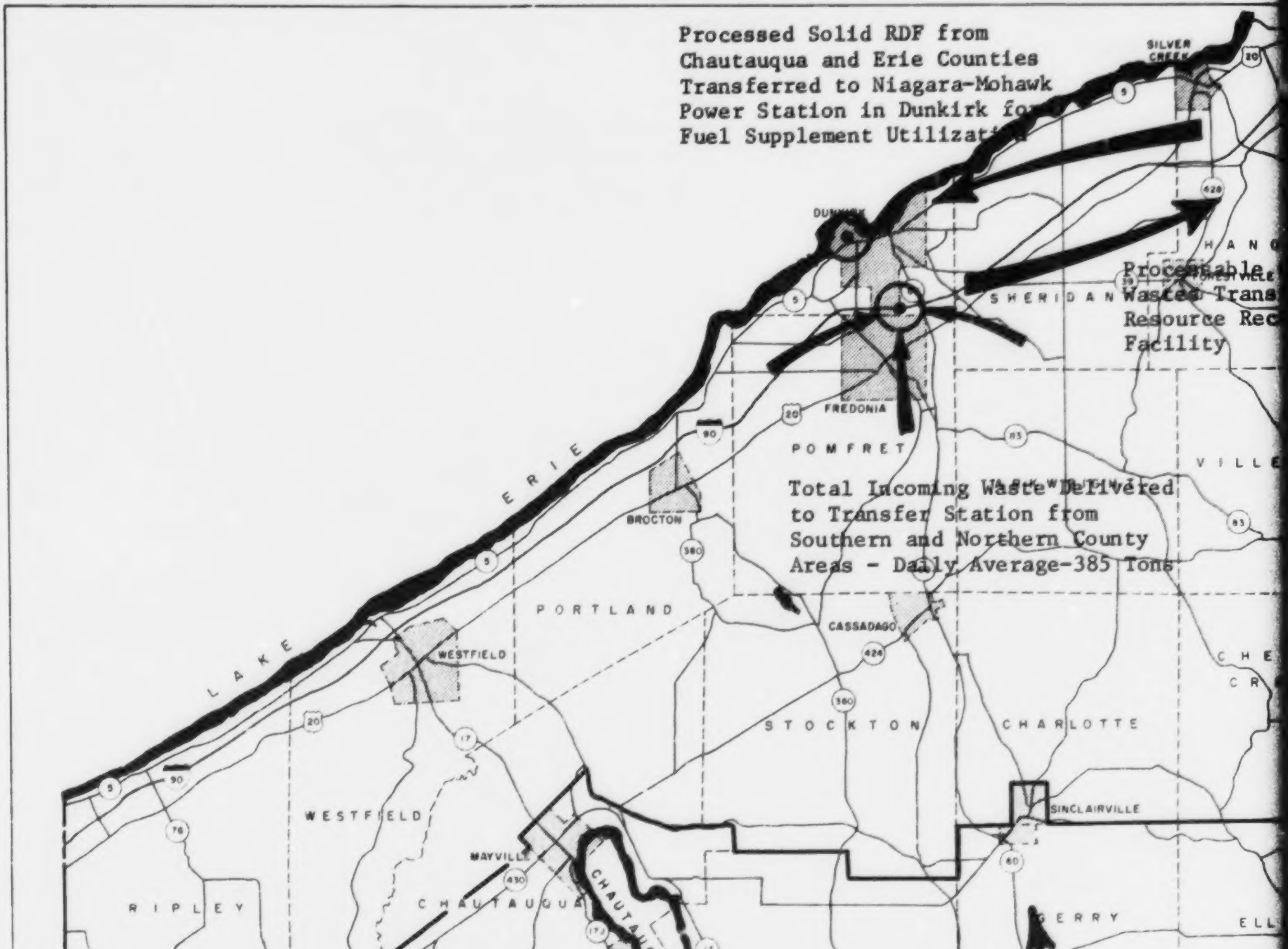
TABLE 7-25

POTENTIAL COSTS AND CREDITS FOR ALTERNATIVE E

1.	Tipping Fee to Process Chautauqua County wastes annually at Erie County facility @ $5.00 per ton, 385 tons per day(a)	$ 542,900
2.	Erie County Landfill cost of process residue @ $4.00 per ton, 79 tons per day	89,100
	Estimated Annual Total Cost	$ 632,000
3.	RDF Revenue from Chautauqua County wastes @ $0.85 per MBTU, 287 tons per day	$ 749,000
	Annual Potential Credit to Chautauqua County	$ 117,000

$$\frac{\$117{,}000}{108{,}570 \text{ TPY}} = \$1.10 \text{ credit per ton of waste delivered}$$

(a) Estimated actual cost for the Erie County-Niagara Mohawk resource recovery facility to process Chautauqua County wastes into RDF @ $5.00 per ton.



SILVER CREEK
DUNKIRK
FREDONIA
SHERIDAN
HANO
FORESTVILLE
POMFRET
VILLE
BROCTON
PORTLAND
CASSADAGA
STOCKTON
CHARLOTTE
CHE
CR
LAKE ERIE
WESTFIELD
SINCLAIRVILLE
MAYVILLE
RIPLEY
CHAUTAUQUA
CHAUTAUQUA LAKE
GERRY
ELL
ELLERY
BEMUS POINT
SHERMAN
MINA
NORTH HARMONY
ELLICOTT
POL
FALCONER
CELORON
LAKEWOOD
JAMESTOWN
PANAMA
CLYMER
HARMONY
FRENCH CREEK
BUSTI
KIANTONE
CA
5
20
90
39
60
62
74
76
83
380
394
424
426
430
474
17

Processed Solid RDF from
Chautauqua and Erie Counties
Transferred to Niagara-Mohawk
Power Station in Dunkirk fo
Fuel Supplement Utilizat

Processable
Wastes Trans
Resource Rec
Facility

Total Incoming Waste Delivered
to Transfer Station from
Southern and Northern County
Areas - Daily Average-385 Tons

Southern County
Transferred to
Station in Dun

Incoming Waste Delivered
to Transfer Station
Daily Average-174 TPD

7.202

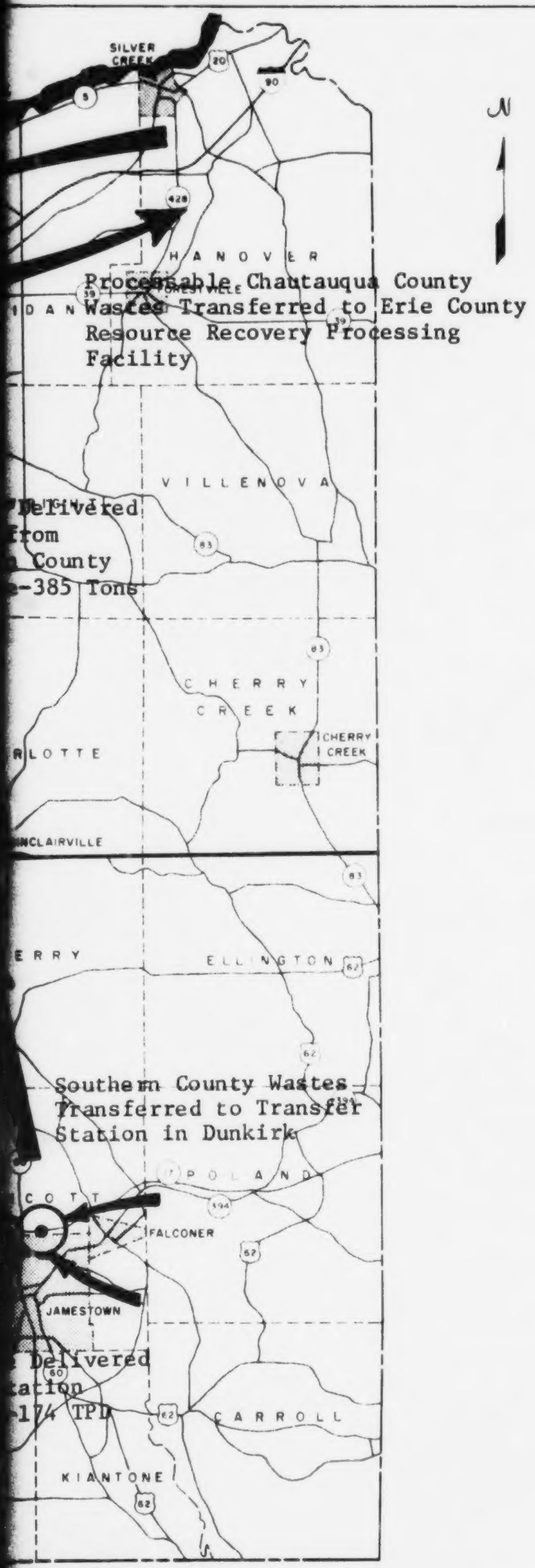

SILVER CREEK
20
90
5
428
N
HANOVER
FORESTVILLE
39
Processable Chautauqua County
Wastes Transferred to Erie County
Resource Recovery Processing
Facility
VILLENOVA
Delivered
from
County
-385 Tons
83
CHERRY CREEK
CHERRY CREEK
RLOTTE
NCLAIRVILLE
ERRY
ELLINGTON
62
Southern County Wastes
Transferred to Transfer
Station in Dunkirk
394
POLAND
COTT
FALCONER
JAMESTOWN
Delivered
ation
-174 TPD
60
CARROLL
KIANTONE
SCALE IN MILES

Figure 7-13

WASTE TRANSPORT SCHEME
TO ERIE COUNTY FOR PROCESSING
CHAUTAUQUA COUNTY WASTES
INTO A SOLID REFUSE DERIVED FUEL

RESOURCE RECOVERY ANALYSIS
CHAUTAUQUA COUNTY, NEW YORK
GILBERT ASSOCIATES, INC.
Reading, Pa.

more economical to operate and the preliminary plan would be for the Erie County-Niagara Mohawk processing plant to be located in or near the Buffalo area and have capacity to process 1,800 - 2,000 tons per day. Therefore the fuel credits that are obtained from Chautauqua County wastes should adequately cover the cost of processing and disposal of the 79 tons per day of processing plant residuals. At such a large processing facility, materials recovery begins to be more economically attractive. It would not be surprising if at least a portion of the 79 tons per day of process residuals could be reclaimed, along with the other estimated 500 tons of Erie County process residuals. Should the Chautauqua County portion of the residuals present a disposal problem in Erie County, it would not be difficult nor too expensive to transport the 79 tons of process residuals back to Chautauqua County for disposal. However, if a cooperative spirit is shown between counties, residue disposal should not be a significant issue, keeping in mind that the Dunkirk Power Station is located in Chautauqua County.

Potential Revenue Posture

A tipping fee for processing Chautauqua County wastes could be charged to Chautauqua County by the Erie County-Niagara Mohawk System. Should it be less than the expected revenue potential of the Chautauqua County wastes as a fuel supplement, i.e. less than the $6.90 per ton of unprocessed wastes delivered at $0.85 per MBTU, the difference could be credited to Chautauqua County to defray the cost of constructing a transfer station system. For example, referring to Table 7-25, Erie County-Niagara Mohawk system could charge Chautauqua County $5.00 per ton to process their waste and also to dispose of the residual from the processing plant. Accounting for the potential revenue from the sale of RDF, there is $1.10 credit per ton generated by the sale of the processed wastes as RDF. This revenue could be credited to Chautauqua and be used to defray the cost of the transfer station system.

In the actual analysis of this alternative however, no credit was given for the sale of RDF; and examining the entire system, the total estimated annual cost was less than all other alternatives examined. Refer to Table 7-27.

Impact of Niagara-Mohawk Feasibility Study

The Niagara Mohawk Power Corporation recently conducted an appraisal of the use of solid waste as a supplementary fuel at the Huntley and Dunkirk power stations. The summary and conclusions are provided in Appendix J. The report summary indicated that between 10 to 15 percent RDF supplemental fuel firing of solid wastes with coal is being considered.

The available RDF supplemental waste fuel firing capacity at both the Huntley and Dunkirk stations is 1540 tons per day at 10 percent and 2315 tons per day at 15 percent. Considering the potentially available RDF from Erie County at 2293 to 2411 tons per day (1979 to 1988, respectively), both power stations cannot accommodate the entire quantity of RDF from Erie County at 10 percent firing, and can barely accommodate all of it at 15 percent. Unfortunately there is no available capacity for RDF from either Niagara or

Chautauqua counties at either the 10 or 15 percent RDF firing rates. If the RDF supplemental firing rate is increased to 20 percent, this increases the total combined power plant RDF utilization capacity to approximately 3080 tons per day. The 1979 total RDF generation from Chautauqua, Erie and Niagara counties is 3080 tons per day and 1988 is 3260 tons per day. Therefore, should the firing rate of waste supplemental fuel be increased to 20 percent, the estimated tri-county RDF generation could be utilized entirely until 1979 and slightly decrease in total use by up to 200 tons per day by 1988.

If Chautauqua County is to consider joining a combined system with Erie and Niagara counties, increased supplemental firing to 20 percent will have to be instituted (assuming all estimated RDF waste quantities are actually required under contract to be delivered to the resource recovery processing facilities). Should a lesser amount of wastes actually be delivered to the waste processing plant, then a lesser percentage of RDF supplemental firing will be required at the power plants, in proportion to the quantity of available RDF. This will not be known until discussions between the three counties involved and the Niagara Mohawk Power Corporation ensue and actual waste quantity commitments are made by the counties.

INFLUENCE OF THE PROJECT ON THE COMMUNITY

The previous system descriptions involve a variety of site specific conditions, as well as two basic resource recovery systems, solid and gaseous refuse derived fuel utilization. The influence on the community of each of the system alternatives will vary slightly from one another. There are several specific community influences that will be discussed.

Air quality should not be affected by the resource recovery processing facility. Air discharged from the shredders will only be the process discharge to the air, which may require a filter. Pumping wastes into the receiving area at the resource recovery facility should not pose any air quality difficulties, however some odor problems could arise in the vicinity of the waste receiving area. The combustion of a solid refuse derived fuel should not pose any reduction in air quality, if the existing air pollution control systems on the boilers are functioning. However this will require a detailed examination of the particular air pollution control system associated with the boiler unit selected for conversion to accept a refuse derived fuel.

Water quality should not be affected by the solid refuse derived fuel system. The gaseous refuse derived full system (Purox) requires disposal of wastewater from the condenser operation, resulting in a high Biochemical Oxygen Demand, ranging from 30,000 to 50,000 ppm. Treatment has been included to reduce this to a level of 200 ppm BOD. This wastewater will require further treatment, possibly by discharging into the municipal sewage treatment system.

Residue Management is necessary for the proper disposal of residual from the resource recovery processing facility. Approximately 79 tons per day of solid process residue will require landfilling, assuming no materials recovery, and less if ferrous and non-ferrous markets are achieved. Sanitary landfills have been allocated for residue management of process wastes from the resource recovery facility.

Noise could pose a problem if dwellings are located especially nearby the processing area. Since the shredders will be enclosed in a structure, the level of noise actually emitted to surrounding areas should be minimized. Other factors contributing to noise will be the truck traffic, conveyors, and other process machinery. Since the resource recovery processing plant will be located near a boiler plant, the aspect of truck traffic and noise from the boiler plant in the nearby area should already be an accepted fact. Therefore, any additional noise contributed by a resource recovery processing plant should not pose noticeable levels above those already existing in the area of the boiler plant.

Aesthetics of the area should be preserved. The unprocessed wastes will be deposited into confined waste receiving pits, in an enclosed structure. The refuse processing will also take place in an enclosed structure and the refined waste fuel transport will be performed by pneumatic pipeline or transfer trailer. Therefore, the wastes brought to the plant for processing into a refuse derived fuel and the resource recovery facility should maintain the aesthetic atmosphere of the area.

Resource conservation is one the primary purposes of promoting this project. Resources of land, energy and materials will be conserved with the implementation of the proposed project. Less landfill space will be required for disposal of wastes, since the combustible fraction will be utilized as a fuel and the non-combustible possibly reclaimed as secondary materials. Energy will be produced from wastes, which would otherwise have to be generated from coal or gas. Therefore, coal or gas for the future will have been conserved. Materials from wastes include among others, ferrous metals, aluminum and glass. When these materials are recovered, less raw materials will be required to manufacture goods, thus conserving raw materials. Also it takes less energy to make materials from recycled materials than raw materials.

Employment will be enhanced by the construction of a resource recovery facility. Depending upon the alternative resource recovery system finally selected, between eleven and twenty two and possibly more jobs will be initially required for the operation. This doesn't include secondary jobs that could result at the refuse derived fuel user's facility and any secondary materials markets.

7,23 a

TABLE 7-26

ESTIMATED CAPITAL COST SUMMARY OF RESOURCE RECOVERY SYSTEM ALTERNATIVES(1)
CHAUTAUQUA COUNTY, NEW YORK
1976

		Total System Capital Cost	NYSDEC Construction Grant(2)	Chautauqua County(4) Capital Cost Share - Resource Recovery System Only	Capital Cost Per Daily Tonnage Processed(3)	Total Chautauqua County Capital Cost Share Including Landfill Development(5)
1.	ALTERNATIVE A Energy recovery at BPU with solid-RDF processing plant in Jamestown and transfer station in Dunkirk	$ 5,610,000	$ 2,685,000	$ 2,925,000	$ 7,600	$ 4,925,000
2.	ALTERNATIVE B Energy recovery at BPU with gas-RDF processing plant in Jamestown and transfer station in Dunkirk	$19,940,600	$ 9,850,300	$10,090,300	$28,800	$12,090,300
3.	ALTERNATIVE C-1 Energy recovery at SUNY with a gaseous-RDF plant and the BPU with a solid-RDF plant	$23,695,300	$11,847,700	$11,847,700	$30,800	$13,847,700
4.	ALTERNATIVE C-2 Energy recovery at Cummins Engine Co. and the BPU utilizing a solid-RDF and transfer station in Dunkirk	$ 7,450,900	$ 3,605,500	$ 3,845,500	$10,000	$ 5,845,500
5.	ALTERNATIVE D-1 Energy recovery at Dunkirk Niagara-Mohawk Station with solid-RDF processing plant in Dunkirk and transfer station in Jamestown in conjunction with Erie County's use of the Dunkirk Station	$ 4,859,000	$ 2,260,300	$ 2,598,700	$ 6,800	$ 4,598,700
6.	ALTERNATIVE D-2 Energy recovery at Dunkirk Niagara-Mohawk Station with solid-RDF processing plant in Dunkirk and transfer station in Jamestown. Chautauqua County wastes only.	$ 5,807,000	$ 2,734,300	$ 3,072,700	$ 8,000	$ 5,072,700
7.	ALTERNATIVE E Transfer of Chautauqua County wastes to Erie County-Niagara Mohawk for processing into a solid-RDF	$ 1,097,000	$ 274,250	$ 822,750	$ 2,150	$ 2,822,750

(1) Includes capital cost of Resource Recovery Facility and Transfer Station, if applicable.
(2) 50% Construction grant for resource recovery processing facility; 25% construction grant for transfer stations.
(3) Solid-RDF: 385 tons per day processed; Gaseous RDF: 350 tons per day processed. Includes NYSDEC construction grant.
(4) Does not include capital costs associated with constructing additional landfill disposal sites. This could add an additional $2,000,000 to the local Chautauqua County Capital Cost; (Refer to Appendix E)
(5) Includes 50% NYSDEC construction grant for resource recovery system plus $2,000,000 for landfill development.

TABLE 7-27

ESTIMATED ANNUAL DIRECT COUNTY COST
RESOURCE RECOVERY ALTERNATIVE SYS
CHAUTAUQUA COUNTY, N.Y.
1976

Alternatives	Cost to Own and Operate Resource Recovery Facility Including NYSDEC 50% Construction Solid-RDF @385 TPD; Gas-RDF @350 TPD(1)	Direct County Total Waste Transport Costs(2)	Cost to La Not Acc Recovery @$4.00
1. **ALTERNATIVE A:** Energy Recovery at Jamestown BPU Carlson Station Utilizing a Solid Refuse Derived Fuel			
- Charge BPU for RDF @$0.85/M Btu	$1,300,200 ($12.00 per ton)	$287,600	$343,200
- No charge to BPU for RDF	1,300,200 ($12.00 per ton)	287,600	343,200
2. **ALTERNATIVE B:** Energy Recovery at the Jamestown BPU Carlson Station Utilizing the Purox System (Gasified-RDF)			
Assume 50% Construction Grant:			
- Charge BPU for RDF @$0.85/M Btu	$3,493,200 ($35.40 per ton)	$287,600	$386,900
- No Charge to BPU for RDF	3,493,200 ($35.40 per ton)	287,600	386,900
Assume 100% Construction Grant:			
- Charge BPU for RDF @ $0.85/M Btu	$1,900,000 ($19.25 per ton)	$287,600	$386,900
- No Charge to BPU for RDF	1,900,000 ($19.25 per ton)	287,600	386,900
3. **ALTERNATIVE C-1:** Energy Recovery at Two Locations: (1) SUNY-Fredonia Utilizing Gasified - RDF (2) Jamestown BPU Carlson Station Utilizing Solid RDF			
Assume 50% Construction Grant:			
- Combined SUNY-BPU Systems	$4,124,900 ($38.00 per ton)	$ 85,900(3)	$343,200
Assume 100% Construction Cost for SUNY Purox System:			
- Combined SUNY-BPU Systems	2,599,200 ($24.00 per ton)	$ 85,900(3)	343,200
4. **ALTERNATIVE C-2:** Energy Recovery at Two Locations: (1) Cummins Engine Company (2) Jamestown BPU Carlson Station Both utilizing a Solid-RDF	$1,610,000 ($14.80 per ton)	$287,600	$343,200
5. **ALTERNATIVE D-1:** Energy Recovery at Niagara-Mohawk Dunkirk Power Station Utilizing a Solid RDF from Chautauqua and Erie Counties			
- Resource Recovery Facility in Dunkirk	$ 956,100 ($8.80 per ton)	$384,300	$343,200
6. **ALTERNATIVE D-2:** Energy Recovery at Niagara-Mohawk Dunkirk Power Station utilizing a Solid-RDF from Chautauqua County only			
- Resource Recovery Facility in Dunkirk	$1,033,700 ($9.50 per ton)	$384,300	$343,200
7. **ALTERNATIVE E:** Transfer Chautauqua County Processable Wastes to Erie County Resource Recovery Facility for Processing into a Solid RDF	$ 366,900 ($3.40 per ton)(7)	$129,100(8)	$343,200

NOTES:
(1) Solid-RDF: 385 TPD @ 282 DPY = 108,570 TPY
Gas-RDF: 350 TPD @ 282 DPY = 98,700 TPY
(2) Includes 25% Construction Grant from N.Y.D.E.C. for transfer station capital costs. Annual owning costs at 7% for 10 years. Thus cost includes transfer station costs plus plant residue haul costs. Dunkirk area transfer station: $238,800 + 48,800 = $287,600; Jamestown area transfer station: $332,900 + $51,400 = $384,300
(3) Does not include any transfer stations, only Processing residual haul costs from the resource recovery plants to the landfills.
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RECT COUNTY COST SUMMARY
ALTERNATIVE SYSTEMS
A COUNTY, N.Y.
1976

Cost to Landfill Wastes Not Accepted At Recovery Facility @$4.00 per Ton(4)	Landfill Cost Savings By Utilizing Wastes as Energy Instead of Landfilling(5) (Credit)	Credit For Sale of RDF to Fuel User (Credit)	Total Direct County Alternative System Cost	
			Annual	Cost Per Ton(6)
$343,200	$69,000	$749,000	$1,113,000	$ 5.40
343,200	69,000	0	1,862,000	9.00
$386,900	$64,000	$516,200	$3,587,500	$17.40
386,900	64,000	0	4,103,700	19.90
$386,900	$64,000	$516,000	$1,994,500	$ 9.70
386,900	64,000	0	2,510,500	12.20
$343,200	$69,000	$730,900	$3,754,100	$18.20
343,200	69,000	730,900	2,228,400	$10.80
$343,200	$69,000	$749,000	$1,422,800	$ 6.90
$343,200	$69,000	$749,000	$ 865,600	$ 4.20
$343,200	$69,000	$749,000	$ 943,200	$ 4.60
$343,200	$69,000	Undetermined	$ 770,200(9)	$ 3.75(9)

(4) Solid-RDF facility @ 385 TPD accepted, 275 TPD landfilled (non-processable)
Gas-RDF facility @ 350 TPD accepted, 310 TPD landfilled (non-processable)
(5) Solid-RDF: 306 TPD @ 282 DPY = 86,290 TPY @ $0.80/ton
Gas-RDF: 283 TPD @ 282 DPY = 79,800 TPY @ $0.81/ton
(6) Total 1985 Waste Quantity Estimate: 660 TPD @ 312 DPY = 205,920 TPY
(7) Includes transfer station debt service and operating costs.
Capital cost of $1,097,000 less 25% NYDEC grant = $822,750 local share,
(@7% 10 years). $117,200 + $249,700 = $366,900.
(8) Includes costs of transfer trailers and tractors only
(9) Assume no credit from RDF sale.

TABLE 7-28

ESTIMATED ANNUAL DIRECT COUNTY COST SU
RESOURCE RECOVERY ALTERNATIVE SYSTEMS
WITH NO NYSDEC 50% CONSTRUCTION GRA
CHAUTAUQUA COUNTY, N.Y.
1976

Alternatives	Cost to Own and Operate Resource Recovery Facility With NO NYSDEC 50% Construction Grant Solid-RDF @385 TPD; Gas-RDF @350 TPD(1)	Direct County Total Waste Transport Costs(2)	Cost to La Not Acc Recovery @4.00
1. ALTERNATIVE A: Energy Recovery at Jamestown BPU Carlson Station Utilizing a Solid Refuse Derived Fuel			
- Charge BPU for RDF @0.85/M Btu	$1,720,100 ($15.85 per ton)	$287,600	$343,200
- No charge to BPU for RDF	1,720,100 ($15.85 per ton)	287,600	343,200
2. ALTERNATIVE B: Energy Recovery at the Jamestown BPU Carlson Station Utilizing the Purox System (Gasified-RDF)			
- Charge BPU for RDF @0.85/M Btu	$5,086,400 ($51.50 per ton)	$287,600	$386,900
- No Charge to BPU for RDF	5,086,400 ($51.50 per ton)	287,600	386,900
3. ALTERNATIVE C-1: Energy Recovery at Two Locations: (1) SUNY-Fredonia Utilizing Gasified - RDF (2) Jamestown BPU Carlson Station Utilizing Solid RDF			
- Combined SUNY-BPU Systems	$5,811,700 ($53.50 per ton)(7)	$ 85,900(3)	$343,200
4. ALTERNATIVE C-2: Energy Recovery at Two Locations: (1) Cummins Engine Company (2) Jamestown BPU Carlson Station Both Utilizing a Solid-RDF	$2,180,600 ($20.10 per ton)(8)	$287,600	$343,200
5. ALTERNATIVE D-1: Energy Recovery at Niagara-Mohawk Dunkirk Power Station Utilizing a Solid RDF from Chautauqua and Erie Counties			
- Resource Recovery Facility at Dunkirk	$1,298,400 ($12.00 per ton)	$384,300	$343,200
6. ALTERNATIVE D-2: Energy Recovery at Niagara-Mohawk Dunkirk Power Station utilizing a Solid-RDF from Chautauqua County only			
- Resource Recovery Facility in Dunkirk	$1,453,700 (13.40 per ton)	$384,300	$343,200
7. ALTERNATIVE E: Transfer Chautauqua County Processable Wastes to Erie County Resource Recovery Facility for Processing into a Solid RDF	$ 405,900 ($3.75 per ton)(9)	$129,100(10)	$343,200

NOTES:
(1) Solid-RDF: 385 TPD @ 282 DPY = 108,570 TPY
Gas-RDF: 350 TPD @ 282 DPY = 98,700 TPY
(2) Includes 25% Construction Grant from N.Y.D.E.C. for transfer station capital costs. Annual owning costs at 7% for 10 years. Thus cost includes transfer station costs plus plant residue haul costs. Dunkirk area transfer station: $238,800 + 48,800 = $287,600
Jamestown area transfer station: $332,900 + 51,400 = $384,300
(3) Does not include any transfer stations, only Processing residual haul costs from the resource recovery plants to the landfills.

(4)

(5)

(6)

(7)

(8)

(9)

(10)

(11)

7-28

COUNTY COST SUMMARY
ERNATIVE SYSTEMS
NSTRUCTION GRANT
NTY, N.Y.
5

Cost to Landfill Wastes Not Accepted At Recovery Facility @4.00 per Ton(4)	Landfill Cost Savings By Utilizing Wastes as Energy Instead of Landfilling(5) (Credit)	Credit For Sale of RDF to Fuel User (Credit)	NO 50% CONSTRUCTION GRANT Total Direct County Alternative System Cost	
			Annual	Cost Per Ton(6)
$343,200	$69,000	$749,000	$1,532,900	$ 7.40
343,200	69,000	0	2,281,900	11.10
$386,900	$64,000	$516,200	$5,180,700	$25.20
386,900	64,000	0	5,696,900	27.70
$343,200	$69,000	$730,900	$5,440,900	$26.40
$343,200	$69,000	$749,000	$1,993,400	$ 9.70
$343,200	$69,000	$749,000	$1,207,900	$ 5.90
$343,200	$69,000	$749,000	$1,363,200	$ 6.60
$343,200	$69,000	Undertermined	$ 809,200(11)	$ 3.95(11)

(4) Solid-RDF facility @ 385 TPD accepted, 275 TPD landfilled (non-processable)
Gas-RDF facility @ 350 TPD accepted, 310 TPD landfilled (non-processable)

(5) Solid-RDF: 306 TPD @ 282 DPY = 86,290 TPY @ $0.80/ton
Gas-RDF: 283 TPD @ 282 DPY = 79,800 TPY @ $0.81/ton

(6) Total 1985 Waste Quantity Estimate: 660 TPD @ 312 DPY = 205,920 TPY

(7) Debt service @ 7% 10 years on $23,695,300 plus annual operating cost and coverage:
$3,373,700 + $2,185,000 + $253,000 = $5,811,700.

(8) Debt service @ 7% 10 years on $6,970,900 plus annual operating cost and coverage:
$992,500 + $1,039,200 + $148,900 = $2,180,600

(9) Includes transfer station debt, service and operating costs.
Capital cost of $1,097,000 @ 7% 10 years plus annual operating
cost: $156,200 + 249,700 = $405,900

(10) Includes costs of transfer trailers and tractors operation only

(11) Assumed no credit from RDF sale

TABLE 7-29

COMPARISON OF ESTIMATED ANNUAL DIRECT COUNTY COSTS WITH AND WITHOUT THE 50% NYSDEC CONSTRUCTION GRANT FOR ALTERNATIVE RESOURCE RECOVERY SCHEMES
CHAUTAUQUA COUNTY, N.Y.
1976

	Alternatives	NO NYSDEC 50% Construction Grant (Table 7-28) Total System Direct County Costs		WITH NYSDEC 50% Construction Grant (Table 7-27) Total System Direct County Costs	
		Annual	Cost Per Ton	Annual	Cost Per Ton
1.	**ALTERNATIVE A:** Energy Recovery at Jamestown BPU Carlson Station Utilizing ~~a~~ Solid Refuse Derived Fuel				
	- Charge BPU Fee for RDF	$1,532,900	$ 7.40	$1,113,000	$ 5.40
	- No Charge to BPU for RDF	$2,281,900	$11.10	$1,862,000	$ 9.00
2.	**ALTERNATIVE B:** Energy Recovery at the Jamestown BPU Carlson Station Utilizing the Purox System (Gasified-RDF)				
	- Charge BPU for RDF	$5,180,700	$25.20	$3,587,500	$17.40
	- No Charge to BPU for RDF	$5,696,900	$27.70	$4,103,700	$19.90
3.	**ALTERNATIVE C-1:** Energy Recovery at Two Locations: SUNY-BPU	$5,440,900	$26.40	$3,754,100	$18.20
4.	**ALTERNATIVE C-2:** Energy Recovery at Two Locations: Cummins-BPU	$1,993,400	$ 9.70	$1,422,800	$ 6.90
5.	**ALTERNATIVE D-1:** Energy Recovery at Niagara-Mohawk Dunkirk Power Station Utilizing a Solid RDF from Chautauqua and Erie Counties	$1,207,900	$ 5.90	$ 865,600	$ 4.20
6.	**ALTERNATIVE D-2:** Energy Recovery at Niagara-Mohawk Dunkirk Power Station Utilizing a Solid RDF from Chautauqua County only	$1,363,200	$ 6.60	$ 943,200	$ 4.60
7.	**ALTERNATIVE E:** Transfer Chautauqua County Processable Wastes to Erie County-Niagara Mohawk Resource Recovery Facility for Processing into a Solid RDF	$ 809,200	$ 3.95	$ 770,200	$ 3.75

CONCLUSIONS

1) The field weighing and waste classification survey performed to determine waste quantity estimates and typical waste compositions is described in Chapter 2. Table 2-6 provides a breakdown of Chautauqua County waste composition and compares it with U.S. Environmental Protection Agency municipal waste component estimates. Waste quantities are developed and projected to the year 2010 in Tables 2-10 through 2-11. Different types of waste combinations, and their estimated moisture and heating values, are detailed in Table 2-16. Design parameters utilized in this report, as given in Table 2-16, are the 1985 projected waste quantity of 660 tons per day, utilizing waste Scheme 5 of municipal combustible and non-combustible wastes and industrial combustible wastes only, estimated to be 430 tons per day with a heating value of 5,190 BTU per pound. Based on the assumption that 10% of the collectible wastes will not actually be delivered to the resource recovery facility, only 385 tons per day should be realistically anticipated. Therefore, this was the sum used for the economic evaluation. The remaining 275 tons per day are assumed to be landfilled.

2) Both manufacturers and secondary material dealers did express some interest in obtaining additional quantities of secondary materials. The type of material most sought after was ferrous and non-ferrous metals. Respondents also expressed interest in obtaining various grades of waste paper and glass cullet. Minor interest was shown in obtaining textile waste and reclaimed rubber.

As with the secondary materials currently used, any additional quantities of materials would also have to conform to specifications. In general, the closer a particular commodity can conform to acceptable specifications, the greater will be its marketability.

The secondary materials market is too changeable and long term contracts for specific materials are proving to be unworkable. For detailed discussion of the investigation and findings, refer to Chapter 3.

Potential energy markets investigated for a refuse derived fuel are summarized in Table 3-10. The possible fuel users for an RDF are: Niagara-Mohawk-Dunkirk Station, Jamestown BPU Carlson Station, SUNY-Fredonia, and Cummins Engine Company. Discussion of each potential fuel user is given in Chapter 3.

3) The spectrum of waste transport schemes and costs was developed based on two approaches:

- DIRECT COUNTY COSTS

  This is limited to the annual cost of the transfer station, haul cost to the processing facility from the transfer station, and resource recovery plant residue haul costs.

- TOTAL ESTIMATED COUNTY COST

  This includes direct County costs and waste transport costs from each municipality to the transfer station or resource recovery plant.

  The relative costs can best be appreciated by referring to Tables 6-2 and 7-27.

4) Capital and annual costs associated with producing a gaseous-RDF under almost all conditions outlined in Tables 7-26 and 7-27, exclude the feasible implementation of a gaseous fuel supplement from further consideration. Even if a 100 percent construction grant were somehow provided for the capital costs, the annual operating cost given for Alternative B is $1,994,500 or $9.70 per ton, ranking seventh in overall alternative economic evaluation.

5) The estimated county capital expenditure for each of the resource recovery systems is given in Table 7-26. Following is the economic ranking of the resource recovery alternatives, capital cost, including sanitary landfill development costs.

Alternative	Estimated County Capital Cost including 50% NYSDEC Grant; WITHOUT Sanitary Landfills	Estimated County Capital Cost including 50% NYSDEC Grant; WITH Sanitary Landfills
1. E	$ 822,750	$ 2,822,750
2. D-1	$ 2,598,700	$ 4,598,700
3. A	$ 2,925,000	$ 4,925,000
4. D-2	$ 3,072,700	$ 5,072,700
5. C-2	$ 3,845,500	$ 5,845,500
6. B	$10,090,300	$ 12,090,300
7. C-1	$11,847,700	$ 13,847,700

6) The relative economic rank of annual county cost for the total resource recovery system alternatives examined is provided in ascending order as follows (refer to Table 7-27):

Alternative	Estimated County Annual Cost	Estimated Cost Per Ton
1. E	$ 770,200	$ 3.75
2. D-1	865,600	4.20
3. D-2	943,200	4.60
4. A	1,113,000	5.40
5. C-2	1,422,800	6.90
6. A(1)	1,862,000	9.00
7. B(3)	1,994,500	9.70
8. C-1(3)	2,228,400	10.80
9. B(5)	2,510,500	12.20
10. B(2)	3,587,500	17.40
11. C-1(2)	3,754,100	18.20
12. B(4)	4,103,700	19.90

Notes:
(1) No revenue collected from sale of RDF.
(2) Revenue collected from sale of RDF and 50% construction grant.
(3) Revenue collected from sale of RDF and 100% construction grant.
(4) No revenue collected from sale of RDF and 50% construction grant.
(5) No revenue collected from sale of RDF and 100% construction grant.

7) Examining the New York State Department of Environmental Conservation Construction Grant, it may provide 50% of the capital costs for resource recovery systems. The preceding ranking of alternatives by ascending economic order includes the 50% NYSDEC Construction Grant. Table 7-28 provides the identical information as Table 7-27 with the exception that NO 50% NYSDEC Construction Grant is included to examine the effect of the county costs without the construction grant. The relative economic rank of the annual county cost for the total resource recovery system alternatives examined is given (refer to Table 7-28). There are only nine alternative rankings, since there is no combinations of potential grants (50% - 100%) as was indicated in Table 7-27. It is assumed no grant is provided:

Alternative		Estimated County Annual Cost	Estimated Cost Per Ton
1.	E	$ 809,200	$ 3.95
2.	D-1	1,207,900	5.90
3.	D-2	1,363,200	6.60
4.	A(1)	1,532,900	7.40
5.	C-2	1,993,400	9.70
6.	A(2)	2,281,900	11.10
7.	B(1)	5,180,700	25.20
8.	C-1	5,440,900	26.40
9.	B(2)	5,696,900	27.70

Notes: (1) Revenue collected from sale of RDF.
(2) No revenue collected from sale of RDF.

8) A comparison of the county annual costs of total resource recovery systems, with and without the 50% NYSDEC Construction Grant, is given in Table 7-29. It appears that acceptable differences occur when comparing the top four ranking economic alternatives, as listed in (6) and (7) above. The disposal cost per ton and difference is listed below:

Alternative		Cost Per Ton No Grant	Cost Per Ton 50% DEC Grant	Cost Per Ton Difference	Percentage Increase of No Grant Versus 50% DEC Grant
1.	E[1]	$ 3.95	$ 3.75	$ 0.20	5%
2.	D-1	5.90	4.20	1.70	40%
3.	D-2	6.60	4.60	2.00	43%
4.	A	7.40	5.40	2.00	37%
5.	C-2	9.70	6.90	2.80	41%

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[1] For Alternative E, there is only a 25% NYSDEC construction grant, since only tranfer stations are to be constructed.

From the above information, it appears that the disposal cost per ton for a total resource recovery system alternative is not significantly affected by the NYSDEC construction grant for Alternative E, since it is only 25%. However, the remaining top four alternatives are affected significantly, from $1.70 to $2.80 per ton additional without the 50% NYSDEC Construction Grant. At least the top three alternatives are feasible without the NYSDEC grant, however, for actual consideration of not utilizing the 50% construction grant, it should be qualified to assume that this circumstance would only be considered by the county if the grant monies were not available. If grant monies are available, it is strongly recommended that the county utilize the state funds.

9) Referring to Table 7-27, the estimated least cost approach to a total system resource recovery plan is Alternative E, transferring Chautauqua County wastes to the Erie County-Niagara Mohawk resource recovery facility at $770,200 annually. Referring to Table 7-26, the estimated least capital cost system and local county share including the NYSDEC construction grant is also Alternative E at $822,750, not including sanitary landfill development. Alternative E does not involve construction of a resource recovery facility in Chautauqua County but only a transfer station system.

10) The estimated least cost approach for the construction of a resource recovery facility in Chautauqua County, referring to Table 7-27, is Alternative D-1, energy recovery at the Dunkirk Niagara-Mohawk Power Station in conjunction with Erie County's use of the Dunkirk Station. Chautauqua County would construct its own processing facility located in Dunkirk and a transfer station in Jamestown at an estimated annual cost of $865,600. The total estimated county share of the capital cost is estimated at $2,598,700, without sanitary landfill development (Table 7-26). It is assumed that boiler modification costs at the Dunkirk Station will be paid by the Erie County-Niagara Mohawk system. Chautauqua County will merely provide RDF from their own processing facility.

11) Should participation with Erie County-Niagara Mohawk system prove not to be feasible, Chautauqua County could develop the entire system necessary at the Niagara-Mohawk Dunkirk station by constructing its own resource recovery processing facility in Dunkirk, with a transfer station in Jamestown and finance the boiler modifications at the Dunkirk station, as outlined in Alternative D-2. The estimated annual cost, as given in Table 7-27, is $943,200, the third lowest estimated total resource recovery system cost. The estimated county share of the capital cost is $3,072,700, the fourth lowest when considering only capital cost. The difference between the annual cost and capital cost placement for this alternative is that annual operating as well as debt service costs are considered in the total annual costs, which accounts for the total overall lower annual system cost.

12) The fourth lowest overall annual total system cost is Alternative A, involving energy recovery of a solid-RDF at the Jamestown BPU and utilizing a transfer station in Dunkirk. The estimated annual cost is

$1,113,000, assuming revenues from the BPU for the sale of the refuse derived fuel supplement. The estimated county share of the capital cost is $2,925,000 including the NYSDEC Construction Grant.

13) The four alternatives: E - transfer all waste to Erie County-Niagara Mohawk system; D-1 - Construction resource recovery facility and utilize system established at the Dunkirk station by Erie County-Niagara Mohawk; D-2 - Construct resource recovery facility and modify Dunkirk station boilers for RDF without the Erie County-Niagara Mohawk system plan; and A - construct resource recovery facility and utilize the Jamestown BPU Carlson station: all of the four alternatives are potentially economically feasible, relative to the existing mode of disposal, the sanitary landfill. In light of the ever-growing environmental considerations with respect to waste disposal, usable landfill area should be reserved for those wastes that are presently not processable in a recovery system. With this approach, estimated landfill site life will be doubled, since approximately half of projected 1985 wastes would be processed in the resource recovery system. Current landfill disposal costs are believed to be between $2.50 to $4.00 per ton and the preliminary landfill operating costs are also estimated to be within that range, (refer to Appendix E). The estimated operating cost per ton range of the four alternatives discussed previously are E at $3.75, D-1 at $4.20, D-2 at $4.60 and A at $5.40.

14) Potential political constraints associated with waste transport across county boundaries, as required in Alternative E, could prevent its implementation, even though it is the most cost effective resource recovery method. Other potential problems could be (1) residue disposal in Erie County from the contributing Chautauqua County processed waste stream at the Erie County resource recovery facility, (2) the cost which the Erie County-Niagara Mohawk system would charge Chautauqua County for processing its wastes at their resource recovery facility, (3) potential revenues from the sale of Chautauqua county solid refuse derived fuel - would Erie County rebate any RDF revenues to Chautauqua County or would they keep it all. (4) The possibility for a capital contribution by Chautauqua County to become part of the Erie County-Niagara Mohawk system.

15) A potential future problem exists with the Jamestown BPU Carlson station as a long term fuel user. It currently costs the BPU approximately 2.5 times more to generate electric power than it does to purchase power from the Power Authority of the State of New York. One limiting factor from purchasing all power is the transmission line power capacity to Jamestown. As a result, electric power will have to be generated to supply the difference between the purchased power and the power demand. With the annualized, daily average load demand of approximately 27,900 kwh or 305,000 pph steam over 24 hours, for all alternatives where the BPU is considered as a solid-RDF fuel user (A, C-1 and C-2), the percentage of RDF to be used to supplement coal ranges between 25 - 30%.

16) Alternative C-2; resource recovery at the BPU and Cummins Engine Company, appears to have some potential, considering an estimated annual cost of $1,422,800. For this alternative, two potential fuel users are considered for a solid-RDF, the Jamestown BPU and Cummins Engine Company. An advantage of two fuel users is that if for some reason, one fuel user should go out of business or have to shut down for a period of time, the other fuel user is still utilizing some of the waste fuel produced and providing revenue to the County for the refuse derived fuel that they are using. On the other hand, with two fuel users, logistics of transporting solid-RDF to one of the fuel users must be developed and maintained as well as the additional cost for this capability. Also, this particular alternative, is dependent upon the requirement that Cummins Engine Company construct a boiler facility capable of accepting a solid-RDF and having the load demand of at least 80,000 pph of steam, 24 hours per day.

17) The preliminary examination concerning potential difficulties of converting and operating existing boiler units to utilize a refuse derived fuel is explained in correspondence from a boiler manufacturer and in a report from the Electric Power Research Institute, Appendix D-5 and D-6. Initial indications from tests conducted at the Meramac Station of Union Electric Power Corporation, St. Louis indicate no significant problems with boiler modifications, general operations, corrosion, erosion, emissions, and slagging. Ash handling and disposal capability will have to be examined.

18) Since this study included a superficial review of the various boiler plant conditions, specific modifications required can only be determined during an engineering study of the specific steam generating units, allied sub-systems and physical conditions, internal and external to the boiler plant considered for modification.

19) No significant problem influences on the community are anticipated with respect to air quality, water quality, residue management, noise, and aesthetics. Direct employment will require from eleven to twenty-two jobs initially, depending upon the system alternative selected.

RECOMMENDATIONS

In light of the close comparison of costs for Alternatives E, D-1, D-2, and A, all within a $1.65 per ton range (refer to Table 7-27), several recommen-ded options for Chautauqua County are given:

1) Beginning with the least total cost resource recovery system (Alternative E), utilizing the Erie County Nigara-Mohawk resource recovery processing system, via transfer trailer hauling of Chautauqua unprocessed wastes, Chautauqua County officials should explore, with the appropriate Erie County and Niagara-Mohawk officials, the possibility of implementing a regional multi-county resource recovery system. It will be necessary to initially explore Niagara-Mohawk's interest to participate in such a proposal with Chautauqua County. Focal points of the initial discussion could include:

   - will potential problems arise from transporting processed and unprocessed wastes across county boundaries;
   - residue management from processed wastes at the resource recovery facility;
   - Niagara-Mohawk Erie County tipping fee;
   - potential RDF revenue posture of Erie County with respect to sale of contributing Chautauqua County RDF;
   - capital contributions;
   - basic type agreement necessary between Niagara-Mohawk, Erie County and Chautauqua County.
   - length of agreement.

2) Should the discussions concerning potential implementation of Alternative E not prove fruitful, Chautauqua County officials could then approach the Niagara-Mohawk with the recommended program outlined for Alternative D-1, which provides that Chautauqua County construct its own resource recovery facility, but utilize the Niagara-Mohawk-Dunkirk Station as a fuel user of solid-RDF along with Erie County wastes. Chautauqua County would deliver solid-RDF to the receiving area at the Dunkirk Station.

   Thus, the only interface with Erie County wastes would be that Chautauqua County would use the same RDF receiving area at the Dunkirk Station. It should be noted again that the Chautauqua County and Erie County solid-RDF are both being processed to a 75 percent refined fuel fraction. Therefore, it is anticipated that there will not be any significant difference in burning characteristics. Each processing plant will be required to maintain the necessary quality control.

3) If the Erie County wastes are not utilized at the Dunkirk Power Station, Chautauqua County could follow the plan outlined in Alternative D-2, which includes Chautauqua County constructing its own resource recovery system and utilizing the Dunkirk Power Station as an RDF fuel user. The difference between Alternatives D-1 and D-2 is that Erie County wastes are not utilized at the Dunkirk Station, at least at that point in time. The Chautauqua County officials could contact the Niagara-Mohawk Power Company to work out the details of the proposed resource recovery plan outlined in Alternative D-2.

4) Should terms with the Niagara-Mohawk Power Company not be workable, Chautauqua County officials could proceed to discuss the plan outlined in Alternative A - utilizing the Jamestown BPU Carlson Station with a solid-RDF supplement.

If the BPU is not willing to accept all the solid-RDF, the Cummins Engine Company at Lakewood should be contacted and talks should then proceed with the Jamestown BPU and Cummins Engine Company officials, both using a solid-RDF. This is the plan outlined for Alternative C-2. Required here will be a commitment from the Cummins Engine Company as to (1) when they plan to construct their new boiler facility, (2) insure that the new boiler facility will be capable of accepting a solid prepared refuse derived fuel; (3) insure their load projections for the boiler facility are at least those used to determine the feasibility of this Alternative (80,000 pph steam over 24 hours); (4) it would be desireable if the new boiler facility could be designed to accept a greater portion of RDF that was expressed as a minimum in the Alternative C-2 discussion, so that during BPU outages for repair, etc., the Cummins Engine Company facility could accept at least some of the excess RDF. This greater capacity would also reduce on-site storage requirements at Cummins.

5) Once a definite fuel user(s) has been established, the county should then pursue a detailed feasibility study with preliminary design to obtain definitive costs for the resource recovery system finally selected.

6) Should the New York State Department of Environmental Conservation Construction Grant for 50% of the capital costs not be available, Chautauqua County could consider proceeding with the three top ranked resource recovery alternatives E, D-1 and D-2. The costs for each of these alternatives, with and without the grant, have been presented in Table 7-29, and the percent increase in disposal cost per ton was presented in the conclusion section, Paragraph (8).

Since the incremental additional costs per ton is small with the NYSDEC Construction Grant, for the first four recommended alternatives (E, D-1, D-2, A), the County should proceed to implement one of these programs.

7) The recommended type of County management necessary to oversee the resource recovery system is described in greater detail in Chapter 8. Basically it entails the expansion of the existing County solid waste department, with an Administrator and two assistants, for all solid waste activities including the resource recovery program. One Assistant Administrator would help manage the resource recovery activities and the other would manage the necessary landfill program.

CHAPTER 8

IMPLEMENTATION STRATEGY

INTRODUCTION

Several concepts will be presented in this chapter including a suggested County organizational structure, potential implementation schemes, compositional aspects of contractual agreements, and possible financing methods. All of these aspects will provide guidance in implementing a resource recovery system.

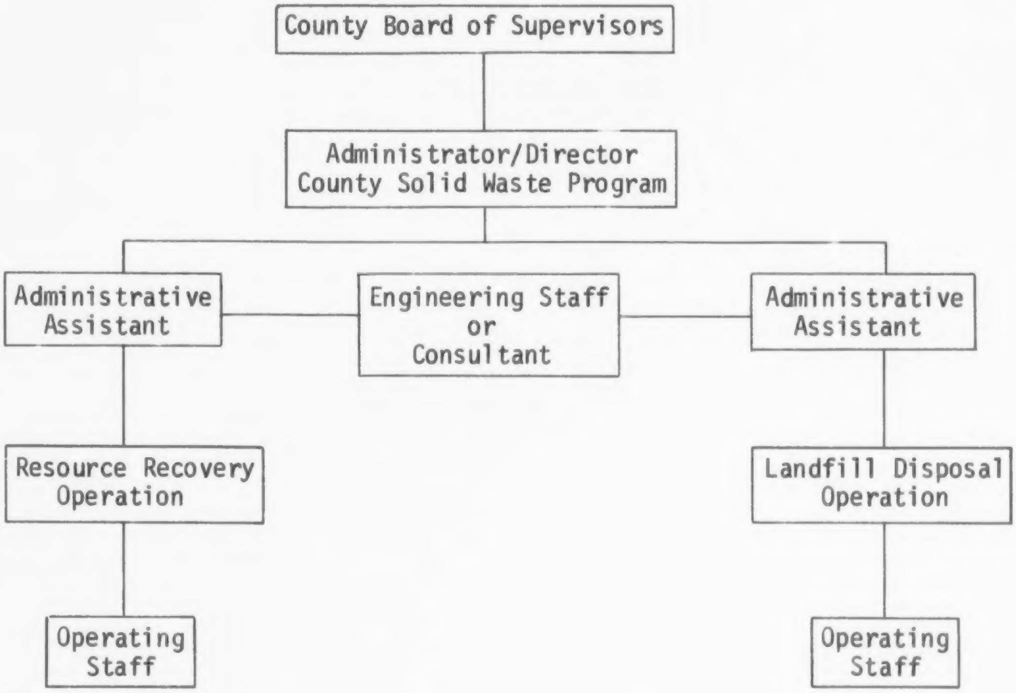
SUGGESTED COUNTY ORGANIZATION STRUCTURE

Chautauqua County already has an organizational structure which handles the solid waste disposal activities within the county. It is suggested for the implementation of a county-wide resource recovery program that the existing County solid waste management structure be expanded modestly as illustrated in Figure 8-1. An Administrator/Director for solid waste activities in Chautauqua County could be selected by the County Board of Supervisors to coordinate and monitor the entire County program. His function as Administrator/Director would involve the initial organizational effort required to get the resource recovery program "off the ground" and involve finalizing the selection of the potential fuel users, a resource recovery system, financing and contractual agreements as well as the necessary public relations program and budgetary administrative details. Initially, at least one Administrative Assistant will be required to continue the daily administrative details of the ongoing County operated landfill disposal program. As the Administrator/Director proceeds to develop the resource recovery program, a second Administrative Assistant will probably be necessary to aid in coordinating design and/or construction of the resource recovery facilities with the design engineer and construction firm. Later, when the resource recovery facility is operating, this second Administrative Assistant would, in effect, become the Manager, making certain the facility operation is satisfactory, monitoring the transfer station operations, coordinating the RDF fuel deliveries to the fuel user(s), and constantly monitoring the secondary materials industry (markets) for potential sale of the resource materials extracted from wastes processed. Both Administrative Assistants would draw upon either an inhouse or County engineering staff or consulting engineering firm for specialized problems, investigations or design.

With the possible exception of Alternative E, all other alternatives recommended should operate efficiently with the structure suggested. For Alternative E, the second Administrative Assistant may not be needed, since only a transfer station system is involved. The Administrator/Director could possibly coordinate the activity himself, with the aid of the first Administrative Assistant.

FIGURE 8-1

SUGGESTED ORGANIZATION FOR MODIFYING THE EXISTING COUNTY SOLID WASTE ORGANIZATION


County Board of Supervisors
Administrator/Director County Solid Waste Program
Administrative Assistant
Engineering Staff or Consultant
Administrative Assistant
Resource Recovery Operation
Landfill Disposal Operation
Operating Staff
Operating Staff

POTENTIAL IMPLEMENTATION SCHEMES

Involvement in ownership and operation of the resource recovery facilities will probably be one factor in implementing the project. For Alternative E, it would be most efficient if the County operated the proposed transfer station system. For the other alternatives, however, other possibilities of owner-ship and operation are not quite as acamedic and should be explored if the program is investigated further. The potential implementation schemes presented in Table 8-1 are provided as a basis for future investigation.

POTENTIAL IMPLEMENTATION SCHEMES

TABLE 8-1

1. Chautauqua County builds, owns, and operates the solid-RDF resource recovery facility. The fuel user(s) maintains his receiving RDF and boiler feed installation.
2. Chautauqua County and the fuel user(s) jointly construct, own, and operate the resource recovery facility.
3. Chautauqua County owns the resource recovery facility, the fuel user operates the facility. The County provides the wastes to the facility and removes the residuals.
4. Chautauqua County only provides waste to the resource recovery facility (removes the residuals). The fuel user owns and operates the resource recovery facility.
5. Chautauqua County contracts with private industry to either operate, build and operate; or build, own and operate a resource recovery facility. Depending on the arrangement, either private industry or Chautauqua County would contract with a fuel user(s), and for sale of recoverable secondary materials.

Costs of the above schemes will, of course, be an important criteria in determining the final scheme selected. An important aspect of County involve-ment in the owning of the resource recovery facility is that the New York State DEC Construction Grant for 50% of the capital costs will be available and, at least theoretically, offset County disposal costs. If the County does not participate in ownership of the resource recovery facility, the grant monies for the facility might be forfeited. Should the fuel user elect to operate the facility, he may feel that he has better quality control of the product RDF to be utilized, and this could be a desireable aspect for the fuel user and avoids potential interface problems.

ASPECTS OF CONTRACTUAL AGREEMENTS

The County currently operates the disposal of wastes in Chautauqua County, with no disposal fee charge at the landfill sites. Operating revenues for these landfill sites are obtained from County tax revenues, therefore, no contractual agreements between the municipalities and the County will be required for the delivery of wastes to the designated disposal facility. When a resource recovery system is operational, all municipal wastes will be directed to the resource recovery facility, along with certain industrial wastes (after a thorough inspection of the industrial wastes is made to determine if acceptable for processing).

For a venture involving the preparation of a solid refuse derived fuel from municipal and certain industrial wastes and the sale of the RDF to a fuel user, requires some type of contractual arrangement between Chautauqua County and the fuel user(s).

Contractual arrangements between Chautauqua County and the fuel user(s) will depend on two factors: (1) the type and complexity of the actual ownership and operation of the resource recovery facility (i.e. the five schemes out-lined in Table 8-1) may also include a third party in private industry; (2) if Alternative E is implemented, the only contractual agreement would probably be with Erie County or its designated representative.

The following is a listing of important considerations in developing contractual agreements between the County and a fuel user(s).

- The quantity and quality of the processed refuse derived fuel to be delivered to the fuel user should be specified. The RDF specification could be in daily tonnage and should include (1) anticipated minimum energy content per ton, (2) anticipated range of moisture and ash content, (3) minimum and/or maximum daily quantity of RDF available for delivery, (4) methodology and frequency of monitoring RDF specification adherence (certain waste types excluded from processing, including, for example, chemical and pathogenic hospital wastes and other hazardous wastes.)

- Ownership of the refuse should be delineated, especially if Chautauqua County will not be the owner and/or operator of the resource recovery facility.

- Activities and responsibilities of each participant in the resource recovery program, i.e., the resource recovery facility owner, operator, fuel user and the County, should be detailed. Responsibilities for maintaining respective facilities should be included, for example, the resource recovery plant, RDF receiving areas, RDF surge storage bins, RDF storage silos, and RDF boiler feed equipment and any RDF transport equipment.

- Possible penalties should be detailed if either the RDF fuel supplier or the RDF suel user cannot live up to their respective production/utilization agreement. This could pose potential problems in negotiating the contractual agreement with the fuel user. Since a sufficient land-fill capacity will be developed, and will be capable of handling wastes during user outage periods, a possible agreement could be made that neither party would be penalized. Mechanical problems with the process plant or unscheduled fuel user boiler shutdowns do occur and there is no advantage to penalize one another for legitimate problems. However, there should be recourse for apparent negligence, poor management or unattended, long term outage.

- The revenue arrangements between the fuel user and Chautauqua County should be expressed in dollars per million BTU and float with the ideal current coal market price. A possible incentive to the fuel user to utilize RDF is to charge some percentage less his current coal cost, 75% for example. This would provide economic relief for on-going fuel costs to the fuel user and revenue for the County.

- A means for capitalizing and amortizing the cost of boiler modifications at the fuel user facility could be for the County to include the capital cost for these modifications in their total resource recovery system funding. The fuel user would then agree to pay for the refuse derived fuel at the same equivalent BTU value of his current coal cost for a finite period of time required to amortize his plant modification cost; after which the cost of RDF would be reduced to the agreed lower-incentive level, below the local current coal market price. In this manner, the fuel user only bears operating costs without the burden of separate capitalization and amortization.

- If the fuel user is going to participate in joint ownership and/or operation of the system, the status of each party and responsibilities should be outlined. This would also include the provision for design and construction of the facilities by qualified firms as well as all parties having a voice in the selection of the firm.

- Residue management for resource recovery facility process residuals should be explained and responsibility of the County with respect to supplying an approved landfill site for disposal.

- Identify risks and obligations for all parties involved over the long term such as:

    - quantity and character of mixed municipal refuse
    - technological
    - system management and operation
    - general economy
    - revenue obligations
    - human and property liability

- In addition to control of risks through contractual agreements and insurance, contingency programs should be developed to minimize hardship on any of the parties involved.

    Special circumstances that could occur at both the resource recovery facility and fuel user should be delineated such as strikes, labor problems affecting collection and delivery of wastes, unintentional mechanical failure of processing or utility equipment, and legislative action on the composition of the fuel supply (e.g., banning no-return bottles or local paper drives).

POSSIBLE FINANCING METHODS

Financing the proposed resource recovery system will depend upon the type of scheme the County elects to use for implementation, as outlined in Table 8-1. Assuming that Chautauqua County will be involved in the ownership of the resource recovery system, 50% of the capital costs could be financed by utilizing the New York State Department of Environmental Conservation Construction Grant. This leaves the remaining 50% of the capital costs to be financed locally. County financing will however, be governed by the existing laws of the State of New York. Some possible financing methods the County might consider are:

- General Obligation Bonds - These bonds require voter approval and are backed by the full faith taxing power of the County. Interest on the bonds vary with the market, but are usually sufficiently low to make this an attractive method of raising capital.

- Revenue or Pollution Control Bonds - These bonds are based on the ability of potential revenue from the project to redeem the bonds. There are uncertainties in assuring continuous revenues necessary for discharging the bond obligations and therefore, this financing method may not be applicable for the entire project.

- Loans - The additional project funding required upon receipt of the 50% NYSDEC Construction Grant might be of the magnitude that would be attractive to a financial institution (bank, insurance company, etc.). Flexible terms can sometimes be secured with regards to maturity, payment schedule, and interest levels.

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PROJECT PARTICIPANTS

The following members of the GILBERT ASSOCIATES, INC. staff have participated in the planning and execution of this project and preparation of this report.

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CHAUTAUQUA COUNTY, NEW YORK - REFUSE WEIGHING SURVEY
APRIL 28, THROUGH MAY 9, 1975

GILBERT ASSOCIATES, INC.
READING, PA.

F-1047

PAGE ___ OF ___

DATE: ____________

WEATHER CONDITIONS: ____________

LANDFILL SITE: ____________

			TYPE OF REFUSE				GROSS WEIGHT (LOADED TRUCK)			TARE WEIGHT (TRUCK EMPTY)			
TIME WEIGHED	LOCATIONAL ORIGIN OF REFUSE	COLLECTOR TYPE (PRIVATE-MUNICIPAL)	MUNICIPAL (RURAL URBAN SURBURBAN)	COMMERCIAL (DESCRIBE)	INDUSTRIAL (DESCRIBE)		LFT SIDE	RT SIDE	TOTAL	LFT SIDE	RT SIDE	TOTAL	NET WEIGHT (REFUSE)
1						1st axle							
						2nd axle							
						3rd axle							
						TOTAL							
2						1st axle							
						2nd axle							
						3rd axle							
						TOTAL							
3						1st axle							
						2nd axle							
						3rd axle							
						TOTAL							
4						1st axle							
						2nd axle							
						3rd axle							
						TOTAL							
5						1st axle							
						2nd axle							
						3rd axle							
						TOTAL							

APPENDIX A-1

APPENDIX A-2

WEIGH SURVEY

APRIL 28, 1975 through MAY 9, 1975

CHAUTAUQUA COUNTY, NEW YORK

During the next two week period a weigh survey of all incoming solid wastes to the county landfill sites will be conducted. This weigh survey will facilitate future planning efforts to insure proper solid waste disposal for Chautauqua County.

There may be some delay for collectors disposing their wastes at the landfill site during the weighing procedure. All steps have been taken to weigh trucks in and out of the landfill sites as quickly as possible. Your cooperation in this effort will be greatly appreciated.

APPENDIX A-3

CHAUTAUQUA COUNTY, NEW YORK - MUNICIPAL SOLID WASTE CHARACTERIZATION

APRIL 28, 1975 THROUGH MAY 9, 1975

GILBERT ASSOCIATES, INC.
READING, PA.

SAMPLE NO. __________ DATE __________ TIME __________ WEATHER CONDITIONS __________

LANDFILL SITE ______________________________

LOCATIONAL ORIGIN OF SAMPLE __________ ______________________________

TYPE OF REFUSE SAMPLED Rural, Suburban, Urban

TOTAL REFUSE WEIGHT FROM WHICH SAMPLE WAS TAKEN ______________________________

WASTE COMPONENT SAMPLED	GROSS WEIGHT (CONTAINER + REFUSE) (Lbs.)	TARE WEIGHT (CONTAINER EMPTY) (Lbs.)	NET WEIGHT (REFUSE ONLY) (Lbs.)
1. Paper (Corrugated)			
2. Paper (Newsprint)			
3. Paper (All Others)			
4. Plastic (Rigid)			
5. Plastic (Wrapping)			
6. Rubber/Leather			
7. Textiles			
8. Ferrous Metal			
9. Non-Ferrous Metal			
10. Colored Glass			
11. Clear Glass			
12. Wood			
13. Food Wastes			
14. Yard Wastes			
15. Ashes, Rock, Dirt			
16. Other			

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
FALCONER						
4-28	12,950	15,130	29,120	-	-	57,200
4-29	65,520	-	34,070	2,010	-	101,600
4-30	23,200	5,470	6,770	-	-	35,440
5-1	10,300	-	13,160	8,930	-	32,390
5-2	10,030	4,270	3,110	460	-	18,650
5-3	27,230	1,080 (430)	4,830	-	-	33,570
5-5	38,820	-	6,950	-	-	45,770
5-6	23,750	-	-	-	-	23,750
5-7	13,830	-	-	-	-	13,830
5-8	14,460	2,220	-	9,290 (roofing)	-	25,970
5-9	29,410	7,840	-	-	-	37,250
Total (Lbs.)	269,500	36,010 (430)	98,010	20,690	-	425,420
Total (Tons)	134.75	18.22	99.40	10.35	-	212.71
Daily Average (Tons)	12.25	1.66	4.49	0.94	-	19.34
CASSADAGA						
4-28	7,350	-	7,790	260	-	15,400
4-29	9,120	-	10,090	-	-	19,210
4-30	4,180	-	670	-	-	4,850
5-1	6,620	1,040	2,800	-	-	11,860
5-2	1,090	1,870	1,570	-	-	4,530
5-3	2,220	4,700	1,300	-	-	8,220
5-5	13,530	-	-	-	-	13,530
5-6	1,980	-	-	-	-	1,980
5-7	3,250	-	-	2,090	-	5,340
5-8	1,410	-	-	-	-	1,410
5-9	-	2,110	-	-	-	2,110
Total (Lbs.)	50,750	9,720	24,220	2,350	-	88,440
Total (Tons)	25.38	4.86	12.81	1.18	-	44.22
Daily Average (Tons)	2.31	.44	1.16	.11	-	4.02

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
BEMUS POINT						
4-28	1,240	-	-	2,300	-	3,540
4-29	8,260	-	1,780	-	-	10,040
4-30	1,920	-	880	26,310	2,560	31,670
5-1	-	-	3,370	1,090	-	4,460
5-2	-	-	-	-	-	-
5-3	1,000	-	1,330	-	-	2,330
5-5	4,820	-	2,140	-	-	6,960
5-6	5,180	-	-	-	-	5,180
5-7	4,560	-	-	-	-	4,560
5-8	-	1,880	-	-	-	1,880
5-9	4,610	-	-	5,700	-	10,310
Total (Lbs.)	31,590	1,880	9,500	35,400	2,560	80,930
Total (Tons)	15.80	.94	4.75	17.70	1.28	40.47
Daily Average (Tons)	1.44	.09	.43	1.61	.12	3.68
STOCKTON						
4-28	10,240	-	910	-	-	11,150
4-29	1,580	-	1,350	-	-	2,930
4-30	960	-	-	-	-	960
5-1	890	-	110	-	-	1,000
5-2	2,820	670	-	-	-	3,490
5-3	3,470	-	6,200	900	1,710	12,750
5-5	130	-	-	-	-	130
5-6	4,150	-	3,300	-	-	7,450
5-7	1,770	-	-	-	-	1,770
5-8	10,710	-	-	-	-	10,710
5-9	4,800	-	-	-	-	4,800
Total (Lbs.)	41,520	670	11,870	900	1,710	37,140
Total (Tons)	20.76	.34	6.17	.45	.86	28.57
Daily Average (Tons)	1.89	.03	.56	.04	.08	2.60

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
SINCLAIRVILLE						
4-28	1,760	-	1,060	-	-	2,820
4-29	2,190	-	1,210	-	-	3,400
4-30	800	-	560	-	-	1,360
5-1	-	-	-	-	-	-
5-2	-	-	-	-	8,710	8,710
5-3	12,480	1,990	3,050	-	-	17,520
5-5	26,890	-	-	3,080	-	29,970
5-6	4,150	-	3,300	-	-	7,450
5-7	1,740	-	-	-	-	1,740
5-8	-	-	-	-	-	-
5-9	1,210	3,880	-	-	-	5,090
Total (Lbs.)	51,220	5,870	9,180	3,080	8,170	78,060
Total (Tons)	25.61	2.94	4.59	1.54	4.36	39.03
Daily Average (Tons)	2.33	.27	.42	.14	.40	3.55
ELLERY						
4-28	2,110	-	-	-	-	2,110
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	4,310	-	-	-	-	4,310
5-2	1,740	-	-	-	-	1,740
5-3	20,450	1,350	930	-	-	22,730
5-5	22,780	-	-	-	-	22,780
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	51,390	1,350	930	-	-	53,670
Total (Tons)	25.70	.68	.47	-	-	26.84
Daily Average (Tons)	2.34	.06	.04	-	-	2.44

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
GERRY						
4-28	1,620	-	830	-	-	2,450
4-29	-	-	1,630	-	-	1,630
4-30	450	-	-	-	-	450
5-1	4,320	310	380	-	-	5,010
5-2	3,210	-	-	-	-	3,210
5-3	4,050	1,590	5,130	-	-	10,970
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	1,370	-	-	-	-	1,370
5-8	3,110	-	-	-	-	3,110
5-9	5,720	-	-	-	-	5,720
Total (Lbs.)	23,850	1,900	7,970	-	-	33,920
Total (Tons)	11.93	.95	4.09	-	-	16.96
Daily Average (Tons)	1.08	.09	.37	-	-	1.54
PANAMA						
4-28	-	2,700	-	-	-	2,700
4-29	6,740	-	-	-	-	6,740
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	6,740	2,700	-	-	-	9,440
Total (Tons)	3.37	1.35	-	-	-	4.72
Daily Average (Tons)	.31	.12	-	-	-	.43

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
CELORON						
4-28	9,200	-	-	-	-	9,200
4-29	3,510	-	-	-	-	3,510
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	11,380	-	-	-	-	11,380
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	24,090	-	-	-	-	24,090
Total (Tons)	12.05	-	-	-	-	12.05
Daily Average (Tons)	1.10	-	-	-	-	1.10
FREWSBERG						
4-28	4,700	-	-	-	-	4,700
4-29	5,240	-	-	-	-	5,240
4-30	5,250	-	-	-	-	5,250
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	730	-	-	-	730
5-6	5,080	-	-	-	-	5,080
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	20,270	730	-	-	-	21,000
Total (Tons)	10.14	.37	-	-	-	10.50
Daily Average (Tons)	.92	.03	-	-	-	.95

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
FLUVANA						
4-28	6,130	-	-	-	-	6,130
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	6,130	-	-	-	-	6,130
Total (Tons)	3.07	-	-	-	-	3.07
Daily Average (Tons)	.28	-	-	-	-	.28
ROSS MILLS						
4-28	-	-	890	-	-	890
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	-	-	890	-	-	890
Total (Tons)	-	-	.45	-	-	.45
Daily Average (Tons)	-	-	.04	-	-	.04

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
ELLINGTON						
4-28	-	-	-	-	-	-
4-29	-	-	2,550	-	-	2,550
4-30	-	-	-	-	-	-
5-1	2,780	-	-	-	-	2,780
5-2	-	-	-	-	-	-
5-3	230	1,100	1,240	-	-	2,570
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	3,010	1,100	3,790	-	-	7,900
Total (Tons)	1.51	.55	1.90	-	-	3.95
Daily Average (Tons)	.14	.05	.17	-	-	.36
BUSTI						
4-28	-	-	-	-	-	-
4-29	7,210	-	-	-	-	7,210
4-30	3,740	-	-	-	-	3,740
5-1	5,870	-	-	-	-	5,870
5-2	2,840	-	-	-	-	2,840
5-3	13,360	-	-	-	-	13,360
5-5	11,880	-	-	-	-	11,880
5-6	-	-	-	-	-	-
5-7	3,520	-	-	-	-	3,520
5-8	8,270	-	-	-	-	8,270
5-9	2,850	-	-	-	-	2,850
Total (Lbs.)	59,540	-	-	-	-	59,540
Total (Tons)	29.77	-	-	-	-	29.77
Daily Average (Tons)	2.71	-	-	-	-	2.71

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
BEAR LAKE, PENNSYLVANIA						
4-28	-	-	-	-	-	-
4-29	-	-	1,470	-	-	1,470
4-30	-	410	-	-	-	410
5-1	-	-	-	1,110	-	1,110
5-2	-	1,470	-	-	-	1,470
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	-	1,880	1,470	1,110	-	4,460
Total (Tons)	-	.94	.74	.56	-	2.23
Daily Average (Tons)	-	.09	.07	.05	-	.20
KENNEDY						
4-28	-	-	-	-	-	-
4-29	8,540	-	-	-	-	8,540
4-30	1,610	-	-	-	-	1,610
5-1	-	-	-	-	-	-
5-2	-	-	2,600	-	-	2,600
5-3	4,420	-	1,000	-	-	5,420
5-5	2,680	-	-	-	-	2,680
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	1,970	-	-	5,430	-	7,400
5-9	-	-	-	-	-	-
Total (Lbs.)	19,220	-	3,600	5,430	-	28,250
Total (Tons)	9.61	-	1.80	2.72	-	14.13
Daily Average (Tons)	.87	-	.16	.25	-	1.28

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
BROCTON						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	3,450	-	610	-	-	4,060
5-1	-	-	-	-	-	-
5-2	-	-	360	-	-	360
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	3,450	-	970	-	-	4,420
Total (Tons)	1.73	-	.49	-	-	2.21
Daily Average (Tons)	.16	-	.04	-	-	.20
FREDONIA						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	1,650	-	-	-	-	1,650
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	1,650	-	-	-	-	1,650
Total (Tons)	.83	-	-	-	-	.83
Daily Average (Tons)	.08	-	-	-	-	.08

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
ELLICOTT						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	10,710	-	-	11,820	-	22,530
5-1	-	-	-	-	-	-
5-2	1,000	-	-	-	-	1,000
5-3	150	-	1,650	-	-	1,800
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	1,540	-	-	-	-	1,540
5-8	-	-	-	-	-	-
5-9	-	5,580	-	-	-	5,580
Total (Lbs.)	13,400	5,580	1,650	11,820	-	32,450
Total (Tons)	6.70	2.79	.83	5.91	-	16.23
Daily Average (Tons)	.61	.25	.08	.54	-	1.48
DUNKIRK						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	480	-	-	-	-	480
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	480	-	-	-	-	480
Total (Tons)	.24	-	-	-	-	.24
Daily Average (Tons)	.02	-	-	-	-	.02

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
MAYVILLE						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	1,830	-	-	1,830
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	-	-	1,830	-	-	1,830
Total (Tons)	-	-	.92	-	-	.92
Daily Average (Tons)	-	-	.08	-	-	.08
LAKEWOOD						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	7,690	4,000	-	-	-	11,690
5-3	1,650	1,200	-	-	-	2,850
5-5	3,110	-	-	-	-	3,110
5-6	8,200	-	-	-	-	8,200
5-7	23,920	-	-	-	-	23,920
5-8	8,570	4,160	-	-	-	12,730
5-9	13,580	-	-	-	-	13,580
Total (Lbs.)	66,720	9,360	-	-	-	76,080
Total (Tons)	33.36	4.68	-	-	-	38.04
Daily Average (Tons)	3.03	.43	-	-	-	3.46

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
MAPLE SPRINGS						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	540	-	-	540
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	-	-	540	-	-	540
Total (Tons)	-	-	.27	-	-	.27
Daily Average (Tons)	-	-	.02	-	-	.02
CHERRY CREEK						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	1,990	-	-	-	-	1,990
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	1,990	-	-	-	-	1,990
Total (Tons)	1.0	-	-	-	-	1.0
Daily Average (Tons)	.09	-	-	-	-	.09

TABLE B-1

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
STOCKTON LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
JAMESTOWN						
4-28	133,960	76,270	6,600	27,130	-	243,960
4-29	148,750	81,550	11,410	5,670	15,820	263,200
4-30	136,430	48,250	4,690	34,710	-	224,080
5-1	106,180	83,890	5,550	48,760	5,520	249,900
5-2	138,990	92,650	6,670	52,640	4,290	295,240
5-3	108,940	50,630	42,240	10,290	-	212,100
5-5	175,270	6,990	5,630	11,330	-	199,220
5-6	140,460	-	590	-	-	141,050
5-7	123,960	6,450	-	-	-	130,410
5-8	125,740	28,650	-	15,350	3,020	172,760
5-9	161,660	25,570	-	18,350	-	205,580
Total (Lbs.)	1,500,340	500,900	83,380	224,230	28,650	2,337,500
Total (Tons)	750.17	250.45	41.69	112.12	14.33	1,168.75
Daily Average (Tons)	68.20	22.77	3.79	10.19	1.30	106.25

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
SHERIDAN						
4-28	-	-	9,870	-	-	9,870
4-29	-	-	-	2,420	-	2,420
4-30	14,400	-	-	-	-	14,400
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	2,450	-	1,600	-	-	4,050
5-5	2,160	-	-	-	-	2,160
5-6	1,670	-	1,120	-	-	2,790
5-7	540	2,540	3,470	-	-	6,550
5-8	-	-	-	-	-	-
5-9	200	-	910	-	-	1,110
Total (Lbs.)	21,420	2,540	16,970	2,420	-	43,350
Total (Tons)	10.71	1.27	8.49	1.21	-	21.68
Daily Average (Tons)	.97	.12	.77	.11	-	1.97
FREDONIA						
4-28	101,100	240	8,290	1,150	-	110,780
4-29	68,420	-	-	14,900	-	83,320
4-30	120,610	-	1,800	15,280	9,410	147,100
5-1	97,650	-	10,510	-	1,730	109,890
5-2	96,090	-	1,020	9,700	6,330	108,140
5-3	47,960	-	9,880	1,090	-	58,930
5-5	81,510	11,300	19,330	5,790	55,530	173,460
5-6	19,720	8,040	26,840	7,810	24,250	86,660
5-7	67,050	11,180	28,620	55,510	1,560	163,920
5-8	65,290	4,130	9,180	12,490	-	91,090
5-9	55,730	8,570	21,950	7,970	3,490	97,710
Total (Lbs.)	821,130	43,460	137,420	126,690	102,300	1,231,000
Total (Tons)	410.57	21.73	68.71	63.35	51.15	615.50
Daily Average (Tons)	37.32	1.98	6.25	5.76	4.65	55.95

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
DUNKIRK						
4-28	209,030	19,120	41,080	91,170	50,540	410,940
4-29	188,010	-	7,940	156,090	149,970	502,010
4-30	308,610	9,940	35,980	104,610	27,940	487,080
5-1	324,100	1,600	29,180	136,520	48,030	539,430
5-2	254,880	73,150	132,250	172,410	150,030	782,720
5-3	132,720	23,230	58,870	55,180	70,590	340,590
5-5	118,880	29,980	26,900	83,840	174,350	433,950
5-6	189,170	112,020	23,600	241,810	100,850	667,450
5-7	83,620	65,100	19,150	138,620	147,360	453,850
5-8	70,910	13,540	15,230	119,110	300	219,090
5-9	99,150	132,330	29,360	41,920	39,490	342,250
Total (Lbs.)	1,979,080	480,010	419,540	1,341,280	959,450	5,179,360
Total (Tons)	989.54	240.01	209.77	670.64	479.73	2,589.68
Daily Average (Tons)	89.96	21.82	19.07	60.97	43.61	235.43
BROCTON						
4-28	8,050	-	-	-	-	8,050
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	60	-	-	-	-	60
5-2	7,140	-	-	-	-	7,140
5-3	4,610	-	-	-	-	4,610
5-5	11,860	-	-	-	-	11,860
5-6	3,760	-	-	-	-	3,760
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	9,390	-	50	-	-	9,440
Total (Lbs.)	44,870	-	50	-	-	44,920
Total (Tons)	22.44	-	.03	-	-	22.46
Daily Average (Tons)	2.04	-	-	-	-	2.04

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
STATE UNIVERSITY						
4-28	-	-	-	-	-	-
4-29	8,490	-	-	-	-	8,490
4-30	7,750	-	-	-	-	7,750
5-1	6,770	-	4,300	-	-	11,070
5-2	11,740	-	-	-	-	11,740
5-3	-	-	-	-	-	-
5-4	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	34,750	-	4,300	-	-	39,050
Total (Tons)	17.38	-	2.15	-	-	19.53
Daily Average (Tons)	1.58	-	.20	-	-	1.78
SILVER CREEK						
4-28	-	-	-	-	-	-
4-29	21,400	-	-	-	-	21,400
4-30	-	-	-	-	-	-
5-1	23,850	-	4,940	-	-	28,790
5-2	47,680	-	-	-	-	47,680
5-3	1,970	-	-	-	-	1,970
5-5	-	820	1,160	-	-	1,980
5-6	19,830	3,150	-	-	-	22,980
5-7	-	-	-	-	-	-
5-8	6,110	-	-	2,260	-	8,370
5-9	650	-	-	-	-	650
Total (Lbs.)	121,490	3,970	6,100	2,260	-	133,820
Total (Tons)	60.75	1.99	3.05	1.13	-	66.91
Daily Average (Tons)	5.52	.18	.28	.10	-	6.08

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
HANOVER						
4-28	-	-	-	-	-	-
4-29	9,430	-	-	-	-	9,430
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	9,430	-	-	-	-	9,430
Total (Tons)	4.72	-	-	-	-	4.72
Daily Average (Tons)	.43	-	-	-	-	.43
WESTFIELD						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	8,230	-	-	1,480	-	9,710
5-1	-	-	-	-	-	-
5-2	12,670	-	-	-	-	12,670
5-3	19,700	-	-	-	-	19,700
5-5	-	-	-	-	-	-
5-6	4,350	-	-	-	-	4,350
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	22,230	-	-	-	-	22,230
Total (Lbs.)	67,180	-	-	1,480	-	68,660
Total (Tons)	33.59	-	-	.74	-	34.33
Daily Average (Tons)	3.05	-	-	.07	-	3.12

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
FORESTVILLE						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	9,860	-	-	-	-	9,860
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	680	-	-	-	680
5-6	5,920	-	1,750	-	-	7,670
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	15,780	680	1,750	-	-	18,210
Total (Tons)	7.89	.34	.88	-	-	9.11
Daily Average (Tons)	.72	.03	.08	-	-	.83
POMFRET						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	400	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	400	-	-	-	-	400
Total (Tons)	.20	-	-	-	-	.20
Daily Average (Tons)	.02	-	-	-	-	.02

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
CASSADAGA						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	1,360	-	-	-	-	1,360
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	1,360	-	-	-	-	1,360
Total (Tons)	.68	-	-	-	-	.68
Daily Average (Tons)	.06	-	-	-	-	.06
PORTLAND						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	3,250	-	3,250
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	-	-	-	3,250	-	3,250
Total (Tons)	-	-	-	1.63	-	1.63
Daily Average (Tons)	-	-	-	.15	-	.15

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
LAONA						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	360	-	-	-	-	360
5-9	-	-	-	-	-	-
Total (Lbs.)	360	-	-	-	-	360
Total (Tons)	.18	-	-	-	-	.18
Daily Average (Tons)	.02	-	-	-	-	.02
GAWONDA						
4-28	-	-	-	-	-	-
4-29	-	-	-	-	-	-
4-30	-	-	-	-	-	-
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	4,180	-	-	-	-	4,180
5-9	-	6,610	-	-	7,330	13,940
Total (Lbs.)	4,180	6,610	-	-	7,330	18,120
Total (Tons)	2.09	3.31	-	-	3.67	9.06
Daily Average (Tons)	.19	.30	-	-	.33	.82

TABLE B-2

SOLID WASTE GENERATION BY CATEGORIES FOR MUNICIPALITIES
CHAUTAUQUA COUNTY, NEW YORK
APRIL 28 THROUGH MAY 9, 1975
DUNKIRK LANDFILL SITE

	Household Refuse	Commercial	Yard Cleanup	Industrial	Demolition	Total
NEW YORK STATE THRUWAY						
4-28	-	-	10,680	-	-	10,680
4-29	-	-	-	-	-	-
4-30	-	-	26,550	-	-	26,550
5-1	-	-	-	-	-	-
5-2	-	-	-	-	-	-
5-3	-	-	-	-	-	-
5-5	-	-	-	-	-	-
5-6	-	-	-	-	-	-
5-7	-	-	-	-	-	-
5-8	-	-	-	-	-	-
5-9	-	-	-	-	-	-
Total (Lbs.)	-	-	37,230	-	-	37,230
Total (Tons)	-	-	18.62	-	-	18.62
Daily Average (Tons)	-	-	1.69	-	-	1.69

TABLE B-3

MUNICIPAL SOLID WASTE CHARACTERIZATION
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

STOCKTON LANDFILL SITE

		Sample No. 1		Sample No. 2	
		April 28, 1975 Urban Household Refuse Jamestown (Fairview Area); M.C. Sample Weight: 354.5 lbs. Total Refuse Weight from Which Sample Taken: 8440 lbs.		April 28, 1975 Rural Household Refuse Kennedy Area; P.C. Sample Weight: 308.5 lbs. Total Refuse Weight from Which Sample Taken: 4720 lbs.	
	Waste Components Characterized	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)
1	Paper (corrugated)	6.2	523.3	12.0	566.4
2	Paper (newsprint)	12.0	1,012.8	23.7	1,118.5
3	Paper (all others)	32.4	2,734.6	7.1	335.1
4	Plastic (rigid)	1.0	84.4	0.7	33.0
5	Plastic (wrapping)	2.0	168.8	4.5	212.4
6	Rubber/Leather	0.9	76.0	-	-
7	Textiles	0.6	50.6	4.5	212.4
8	Ferrous Metals	6.9	582.4	9.1	429.5
9	Non-Ferrous Metals	8.5	717.4	11.7	552.2
10	Colored Glass	3.4	287.0	4.5	212.4
11	Clear Glass	6.8	573.9	1.9	89.7
12	Wood	-	-	-	-
13	Food Wastes	6.2	523.3	12.0	566.6
14	Yard Wastes	5.1	430.4	-	-
15	Ashes, Rock, Dirt	-	-	-	-
16	Others	8.0	675.1	8.3	391.8
	TOTAL	100.0	8,440.0	100.0	4,720.0

NOTE: M.C., Municipal Collection; P.C., Private Collection

TABLE B-3

MUNICIPAL SOLID WASTE CHARACTERIZATION
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

STOCKTON LANDFILL SITE

		Sample No. 3 April 30, 1975 Rural/Surburban Refuse Frewsburg Area - Homes & Commercial; P.C. Sample Weight: 488.5 lbs. Total Refuse Weight from Which Sample Taken: 5250 lbs.		Sample No. 4 May 1, 1975 Urban Household Refuse Jamestown (2nd Street Area); M.C. Sample Weight: 493.5 lbs. Total Refuse Weight from Which Sample Taken: 15,967 lbs.	
	Waste Components Characterized	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lb
1	Paper (corrugated)	8.0	420.0	7.1	1,133.7
2	Paper (newsprint)	10.8	567.0	5.4	862.2
3	Paper (all others)	6.6	346.5	7.9	1,261.4
4	Plastic (rigid)	6.0	315.0	0.8	127.7
5	Plastic (wrapping)	2.1	110.3	1.7	271.4
6	Rubber/Leather	0.8	42.0	1.6	255.5
7	Textiles	3.3	173.3	5.2	830.3
8	Ferrous Metals	3.6	189.0	4.0	638.7
9	Non-Ferrous Metals	0.7	36.5	2.5	399.2
10	Colored Glass	6.8	357.0	8.3	1,325.3
11	Clear Glass	2.1	110.1	7.9	1,261.4
12	Wood	3.3	173.2	-	-
13	Food Wastes	6.4	336.0	9.1	1,453.0
14	Yard Wastes	3.0	157.5	0.1	16.0
15	Ashes, Rock, Dirt	1.3	68.3	1.4	223.5
16	Others	35.4	1,848.6	37.0	5,907.7
	TOTAL	100.0	5,250.0	100.0	15,967.0

NOTE: M.C., Municipal Collection; P.C., Private Collection

TABLE B-3

MUNICIPAL SOLID WASTE CHARACTERIZATION
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

STOCKTON LANDFILL SITE

Sample No. 5

May 3, 1975
Rural Household Refuse
Busti; P.C.
Sample Weight: 221 lbs.
Total Refuse Weight from Which Sample Taken: 2330 lbs.

	Waste Components Characterized	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)
1	Paper (corrugated)	13.6	316.9
2	Paper (newsprint)	13.4	312.2
3	Paper (all others)	9.1	212.0
4	Plastic (rigid)	2.0	46.6
5	Plastic (wrapping)	0.5	11.7
6	Rubber/Leather	0.5	11.7
7	Textiles	7.2	167.8
8	Ferrous Metals	16.7	389.1
9	Non-Ferrous Metals	0.7	16.3
10	Colored Glass	0.9	21.0
11	Clear Glass	5.9	137.5
12	Wood	2.3	53.6
13	Food Wastes	4.5	104.9
14	Yard Wastes	1.8	41.7
15	Ashes, Rock, Dirt	-	-
16	Other	20.9	487.0
	TOTAL	100.0	2,330.0

NOTE: M.C., Municipal Collection; P.C., Private Collection

TABLE B-4

MUNICIPAL SOLID WASTE CHARACTERIZATION
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

DUNKIRK LANDFILL SITE

		Sample No. 6		Sample No. 7	
		May 6, 1975 Suburban Household Refuse Silver Creek; P.C. Sample Weight: 259.5 lbs. Total Refuse Weight from Which Sample Taken: 5,100 lbs.		May 8, 1975 Suburban Household Refuse Fredonia; M.C. Sample Weight: 82.5 lbs. Total Refuse Weight from Which Sample Taken: 25,920 lbs.	
	Waste Components Characterized	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lb
1	Paper (corrugated)	10.3	525.3	15.9	4,121.3
2	Paper (newsprint)	10.2	520.2	13.9	3,602.9
3	Paper (all others)	13.7	698.7	8.6	2,229.1
4	Plastic (rigid)	0.2	10.2	2.4	622.1
5	Plastic (wrapping)	1.0	51.0	0.6	155.5
6	Rubber/Leather	0.4	20.4	-	-
7	Textiles	2.1	107.1	2.4	622.1
8	Ferrous Metals	11.8	601.8	1.8	466.6
9	Non-Ferrous Metals	4.0	204.0	1.2	311.0
10	Colored Glass	7.6	387.6	3.6	933.1
11	Clear Glass	4.6	234.6	6.1	1,581.1
12	Wood	4.2	214.2	-	-
13	Food Wastes	11.8	601.8	3.6	933.1
14	Yard Wastes	4.4	224.4	12.7	3,291.8
15	Ashes, Rock, Dirt	-	-	3.0	777.7
16	Others	13.7	698.7	24.2	6,272.6
	TOTAL	100.0	5,100.0	100.0	25,920.0

NOTE: M.C., Municipal Collection; P.C., Private Collection

TABLE B-4

MUNICIPAL SOLID WASTE CHARACTERIZATION
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

DUNKIRK LANDFILL SITE

		Sample No. 8 May 8, 1975 Commercial - Cafeteria & Student Union Wastes State University of New York - Fredonia; P.C. Sample Weight: 138.0 lbs. Total Refuse Weight from Which Sample Taken: 1,240 lbs.		Sample No. 9 May 9, 1975 Urban Household Refuse Dunkirk (City); M.C. Sample Weight: 203.5 lbs. Total Refuse Weight from Which Sample Taken: 6,390 lbs.	
	Waste Components Characterized	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)
1	Paper (corrugated)	8.7	107.9	3.0	191.7
2	Paper (newsprint)	-	-	3.7	236.4
3	Paper (all others)	25.4	315.0	3.0	191.7
4	Plastic (rigid)	7.6	94.2	2.7	172.5
5	Plastic (wrapping)	1.1	13.6	2.2	140.6
6	Rubber/Leather	-	-	-	-
7	Textiles	-	-	1.0	63.9
8	Ferrous Metals	-	-	5.2	332.3
9	Non-Ferrous Metals	2.2	27.3	7.9	504.8
10	Colored Glass	-	-	14.7	939.3
11	Clear Glass	-	-	11.3	722.1
12	Wood	-	-	4.4	281.2
13	Food Wastes	29.7	368.3	12.8	817.9
14	Yard Wastes	-	-	4.9	313.1
15	Ashes, Rock, Dirt	-	-	-	-
16	Others	25.3	313.7	23.2	1,482.5
	TOTAL	100.0	1,240.0	100.0	6,390.0

NOTE: M.C., Municipal Collection; P.C., Private Collection

TABLE B-4

MUNICIPAL SOLID WASTE CHARACTERIZATION
APRIL 28 THROUGH MAY 9, 1975
CHAUTAUQUA COUNTY, NEW YORK

DUNKIRK LANDFILL SITE

Sample No. 10

May 9, 1975
Suburban Household Refuse
Brocton; M.C.
Sample Weight: 183.0 lbs.
Total Refuse Weight from Which Sample Taken: 4410 lbs.

	Waste Components Characterized	Percent Weight Composition of Sample (%)	Component Waste Weight of Total Refuse Delivered (lbs)
1	Paper (corrugated)	4.4	194.0
2	Paper (newsprint)	7.9	348.4
3	Paper (all others)	7.4	326.3
4	Plastic (rigid)	0.8	35.3
5	Plastic (wrapping)	2.5	110.3
6	Rubber/Leather	1.9	83.8
7	Textiles	6.6	291.1
8	Ferrous Metals	2.2	97.0
9	Non-Ferrous Metals	3.8	167.6
10	Colored Glass	5.5	242.6
11	Clear Glass	3.8	167.6
12	Wood	-	-
13	Food Wastes	9.8	432.2
14	Yard Wastes	10.9	480.7
15	Ashes, Rock, Dirt	-	-
16	Other	32.5	1,433.1
	TOTAL	100.0	4,410.0

NOTE: M.C., Municipal Collection; P.C., Private Collection

CHAUTAUQUA COUNTY

SOLID WASTE MARKET STUDY

LIST OF EXHIBITS

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EXHIBIT 1

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

County Populations and Distances From Chautauqua County

STATE	COUNTY	1970 POPULATION	APPROXIMATE MEAN DISTANCE FROM CHAUTAUQUA (MILES)
NEW YORK	Steuben	98,600	106
	Orleans	36,837	92
	Livingston	53,441	90
	Genesee	58,268	81
	Niagara	233,188	74
	Allegany	45,342	72
	Wyoming	36,860	69
	Erie	1,103,413	49
	Cattaraugus	80,792	37
	Chautauqua	144,928	0
PENNSYLVANIA	Warren	47,682	32
	Erie	263,654	38
	McKean	51,915	56
	Crawford	81,342	56
	Forest	4,926	58
	Venango	62,353	64
	Elk	37,770	72
	Mercer	127,175	82
	Potter	16,395	88
	Cameron	7,096	90

EXHIBIT 2

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Standard Industrial Code (SIC) Definitions

SIC	DEFINITION
22XX	TEXTILES
2293	Upholstery and Pad Fillings
2294	Processed Waste and Recovered Fibers
26XX	PAPER AND ALLIED PRODUCTS
2631	Paperboard Mills
2643	Bags, Except Textile Bags
2645	Die-Cut Paper and Paperboard and Cardboard
2651	Folding Paperboard Boxes
2652	Set-Up Paperboard Boxes
2653	Corrugated and Solid Fiber Boxes
2655	Fiber Cans, Tubes, Drums and Similar Products
2661	Building Paper and Building Board Mills
30XX	RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS
3011	Tires and Inner Tubes
3031	Reclaimed Rubber
3069	Fabricated Rubber Products, Not Elsewhere Classified
3079	Miscellaneous Plastics Products
32XX	STONE, CLAY AND GLASS PRODUCTS
3211	Flat Glass
3221	Glass Containers
3231	Glass Products, Made of Purchased Glass
3251	Brick and Structural Clay Tile
3253	Ceramic Wall and Floor Tile
3271	Concrete Block and Brick
3272	Concrete Products, Except Block and Brick
33XX	PRIMARY METAL INDUSTRIES
3312	Blast Furnaces (Including Coke Ovens), Steel Works, Rolling Mills
3313	Electrometallurgical Products
3321	Gray Iron Foundries
3322	Malleable Iron Foundries
3323	Steel Foundries
3325	Steel Foundries (Not Elsewhere Classified)
3331	Primary Smelting and Refining of Copper
3332	Primary Smelting and Refining of Lead
3333	Primary Smelting and Refining of Zinc
3334	Primary Production of Aluminum
3341	Secondary Smelting and Refining of Non-Ferrous Metals
3361	Aluminum Foundries (Casting)
3362	Brass, Bronze, Copper, Copper Base Alloy Foundries (Castings)
3369	Non-Ferrous Foundries (Castings), Not Elsewhere Classified

EXHIBIT 3

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Geographical Profile of Manufacturers

SIC 22XX

STATE	COUNTY	NUMBER OF COMPANIES	% OF TOTAL SAMPLE	NUMBER OF EMPLOYEES	% OF TOTAL SAMPLE	AVERAGE EMPLOYEES PER COMPANY
NEW YORK	Steuben	-	-	-	-	-
	Orleans	-	-	-	-	-
	Livingston	-	-	-	-	-
	Genesee	-	-	-	-	-
	Niagara	1	25.0	15	8.6	15
	Allegany	-	-	-	-	-
	Wyoming	-	-	-	-	-
	Erie	1	25.0	85	48.9	85
	Cattaraugus	-	-	-	-	-
	Chautauqua	2	50.0	74	42.5	37
PENNSYLVANIA	Warren	-	-	-	-	-
	Erie	-	-	-	-	-
	McKean	-	-	-	-	-
	Crawford	-	-	-	-	-
	Forest	-	-	-	-	-
	Venango	-	-	-	-	-
	Elk	-	-	-	-	-
	Mercer	-	-	-	-	-
	Potter	-	-	-	-	-
	Cameron	-	-	-	-	-
TOTAL SAMPLE		4	100.0	174	100.0	44

EXHIBIT 4

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Geographical Profile of Manufacturers

SIC 26XX

STATE	COUNTY	NUMBER OF COMPANIES	% OF TOTAL SAMPLE	NUMBER OF EMPLOYEES	% OF TOTAL SAMPLE	AVERAGE EMPLOYEES PER COMPANY
NEW YORK	Steuben	1	2.9	260	7.9	260
	Orleans	1	2.9	24	0.7	24
	Livingston	-	-	-	-	-
	Genesee	2	5.7	174	5.3	87
	Niagara	-	-	-	-	-
	Allegany	-	-	-	-	-
	Wyoming	-	-	-	-	-
	Erie	18	51.3	1,977	60.5	110
	Cattaraugus	-	-	-	-	-
	Chautauqua	4	11.4	116	3.5	29
PENNSYLVANIA	Warren	-	-	-	-	-
	Erie	4	11.4	391	11.9	98
	McKean	2	5.7	282	8.6	141
	Crawford	-	-	-	-	-
	Forest	-	-	-	-	-
	Venango	-	-	-	-	-
	Elk	1	2.9	15	0.5	15
	Mercer	1	2.9	22	0.7	22
	Potter	1	2.9	14	0.4	14
	Cameron	-	-	-	-	-
TOTAL SAMPLE		35	100.0	3,275	100.0	94

EXHIBIT 5

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Geographical Profile of Manufacturers

SIC 30XX

STATE	COUNTY	NUMBER OF COMPANIES	% OF TOTAL SAMPLE	NUMBER OF EMPLOYEES	% OF TOTAL SAMPLE	AVERAGE EMPLOYEES PER COMPANY
NEW YORK	Steuben	-	-	-	-	-
	Orleans	-	-	-	-	-
	Livingston	1	1.3	100	0.9	100
	Genesee	1	1.3	200	1.9	200
	Niagara	5	6.6	462	4.3	92
	Allegany	-	-	-	-	-
	Wyoming	-	-	-	-	-
	Erie	22	28.9	3,493	32.4	159
	Cattaraugus	-	-	-	-	-
	Chautauqua	3	3.9	102	0.9	34
PENNSYLVANIA	Warren	3	3.9	1,518	14.1	506
	Erie	30	39.5	4,081	37.8	136
	McKean	-	-	-	-	-
	Crawford	5	6.6	570	5.3	114
	Forest	1	1.3	137	1.3	137
	Venango	-	-	-	-	-
	Elk	-	-	-	-	-
	Mercer	3	3.9	106	1.0	35
	Potter	2	2.8	26	0.1	13
	Cameron	-	-	-	-	-
TOTAL SAMPLE		76	100.0	10,795	100.0	142

EXHIBIT 6

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Geographical Profile of Manufacturers

SIC 32XX

STATE	COUNTY	NUMBER OF COMPANIES	% OF TOTAL SAMPLE	NUMBER OF EMPLOYEES	% OF TOTAL SAMPLE	AVERAGE EMPLOYEES PER COMPANY
NEW YORK	Steuben	-	-	-	-	-
	Orleans	-	-	-	-	-
	Livingston	1	2.3	68	1.8	68
	Genesee	-	-	-	-	-
	Niagara	2	4.5	103	2.7	52
	Allegany	1	2.3	8	0.2	8
	Wyoming	2	4.5	24	0.6	12
	Erie	14	31.8	925	24.6	66
	Cattaraugus	3	6.8	506	13.5	169
	Chautauqua	2	4.5	274	7.3	137
PENNSYLVANIA	Warren	1	2.3	51	1.4	51
	Erie	4	9.1	154	4.1	39
	McKean	4	9.1	609	16.2	152
	Crawford	4	9.1	664	17.7	166
	Forest	1	2.3	320	8.5	320
	Venango	1	2.3	8	0.2	8
	Elk	1	2.3	10	0.3	10
	Mercer	3	6.8	29	0.8	10
	Potter	-	-	-	-	-
	Cameron	-	-	-	-	-
TOTAL SAMPLE		44	100.0	3,753	100.0	85

EXHIBIT 7

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Geographical Profile of Manufacturers

SIC 33XX

STATE	COUNTY	NUMBER OF COMPANIES	% OF TOTAL SAMPLE	NUMBER OF EMPLOYEES	% OF TOTAL SAMPLE	AVERAGE EMPLOYEES PER COMPANY
NEW YORK	Steuben	-	-	-	-	-
	Orelans	1	1.2	270	0.7	270
	Livingston	2	2.3	59	0.2	30
	Genesee	2	2.3	975	2.5	488
	Niagara	7	8.1	2,091	5.4	299
	Allegany	1	1.2	140	0.4	140
	Wyoming	-	-	-	-	-
	Erie	30	34.8	20,840	53.4	695
	Cattaraugus	-	-	-	-	-
	Chautauqua	8	9.3	2,889	7.4	361
PENNSYLVANIA	Warren	-	-	-	-	-
	Erie	15	17.4	2,742	7.1	183
	McKean	1	1.2	8	0.0	8
	Crawford	4	4.7	1,549	4.0	387
	Forest	1	1.2	25	0.1	25
	Venango	5	5.8	630	1.6	126
	Elk	1	1.2	73	0.2	73
	Mercer	8	9.3	6,592	17.0	824
	Potter	-	-	-	-	-
	Cameron	-	-	-	-	-
TOTAL SAMPLE		86	100.0	38,883	100.0	452

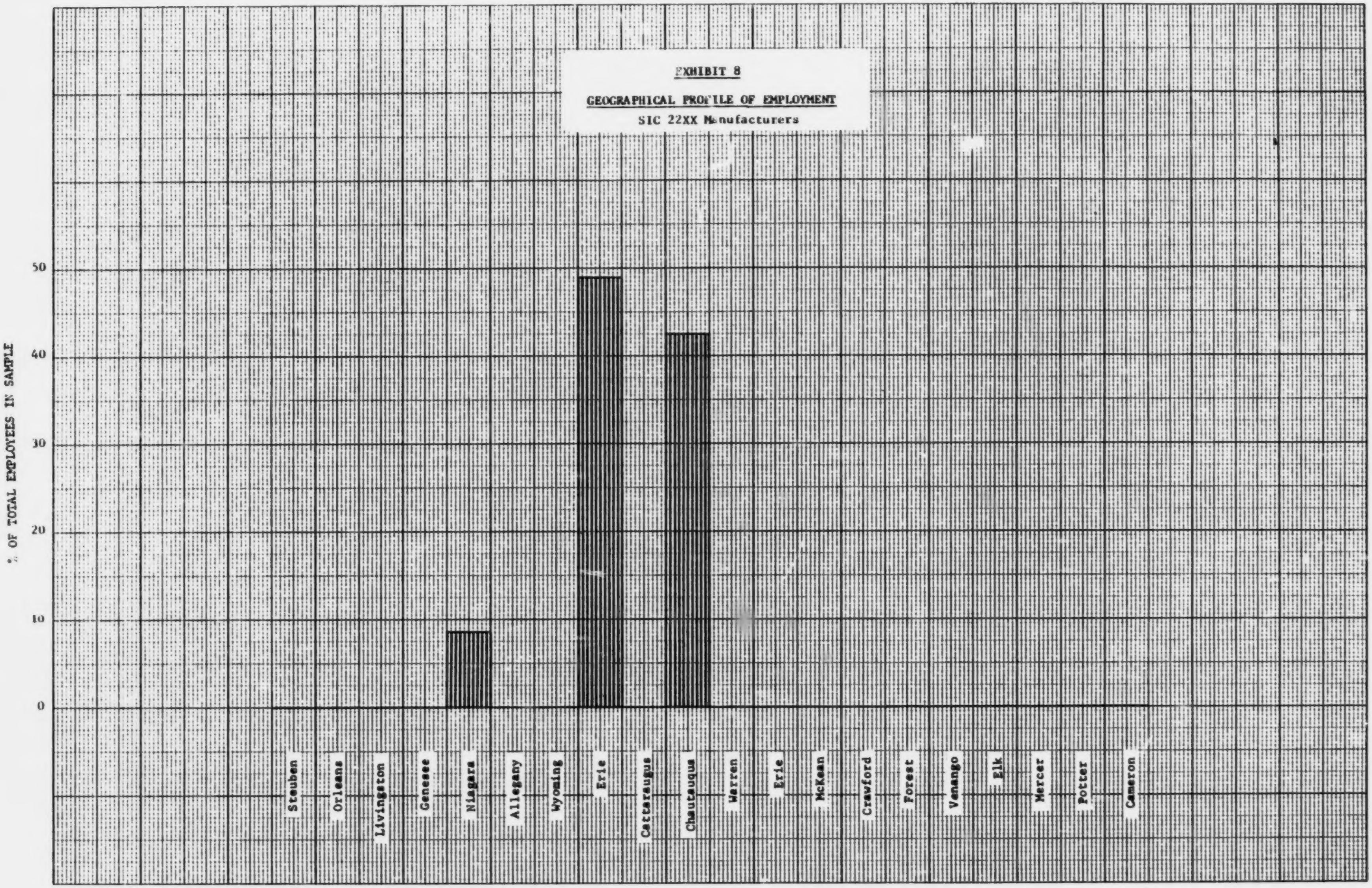


EXHIBIT 8

GEOGRAPHICAL PROFILE OF EMPLOYMENT

SIC 22XX Manufacturers

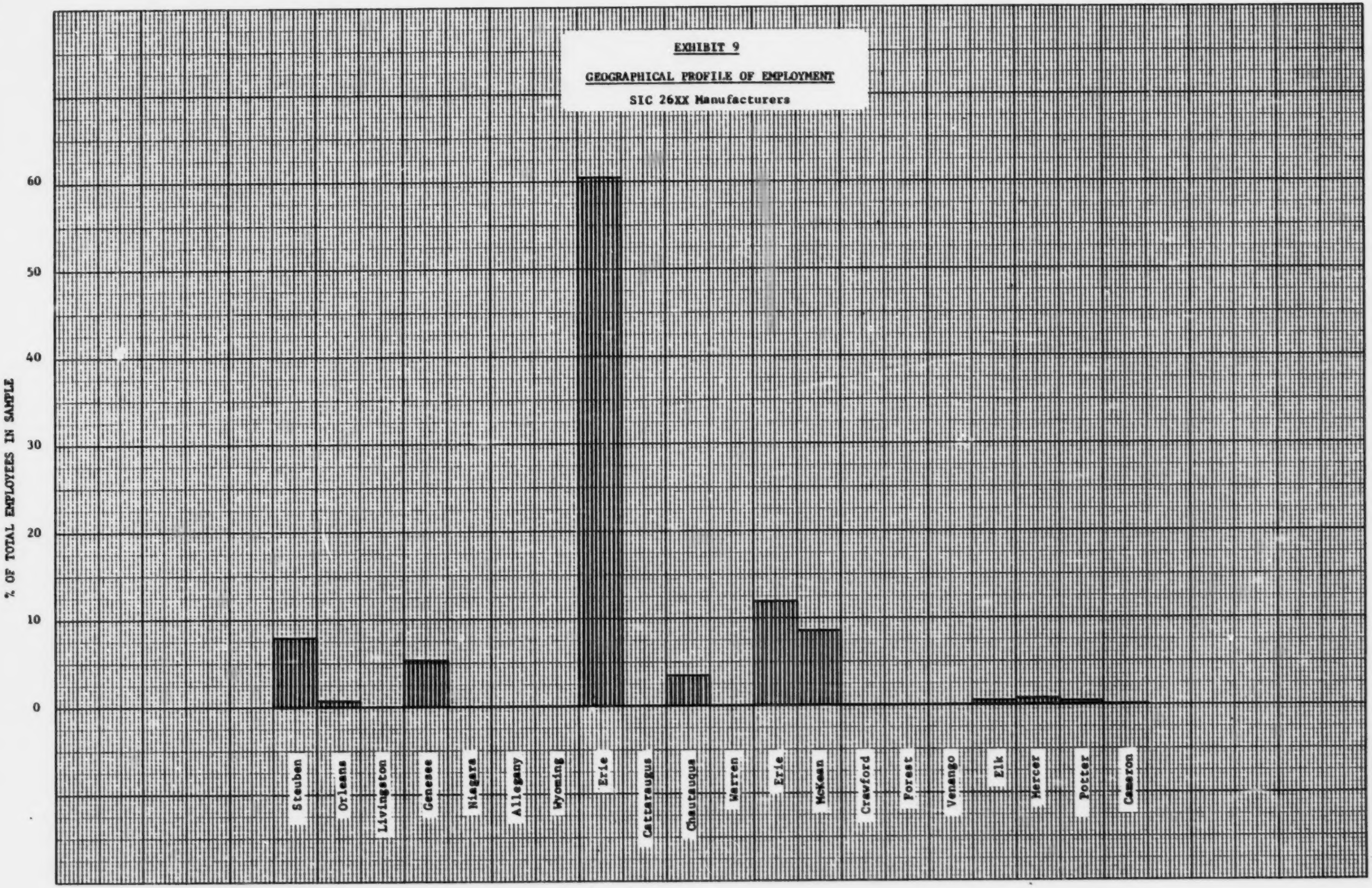


EXHIBIT 9

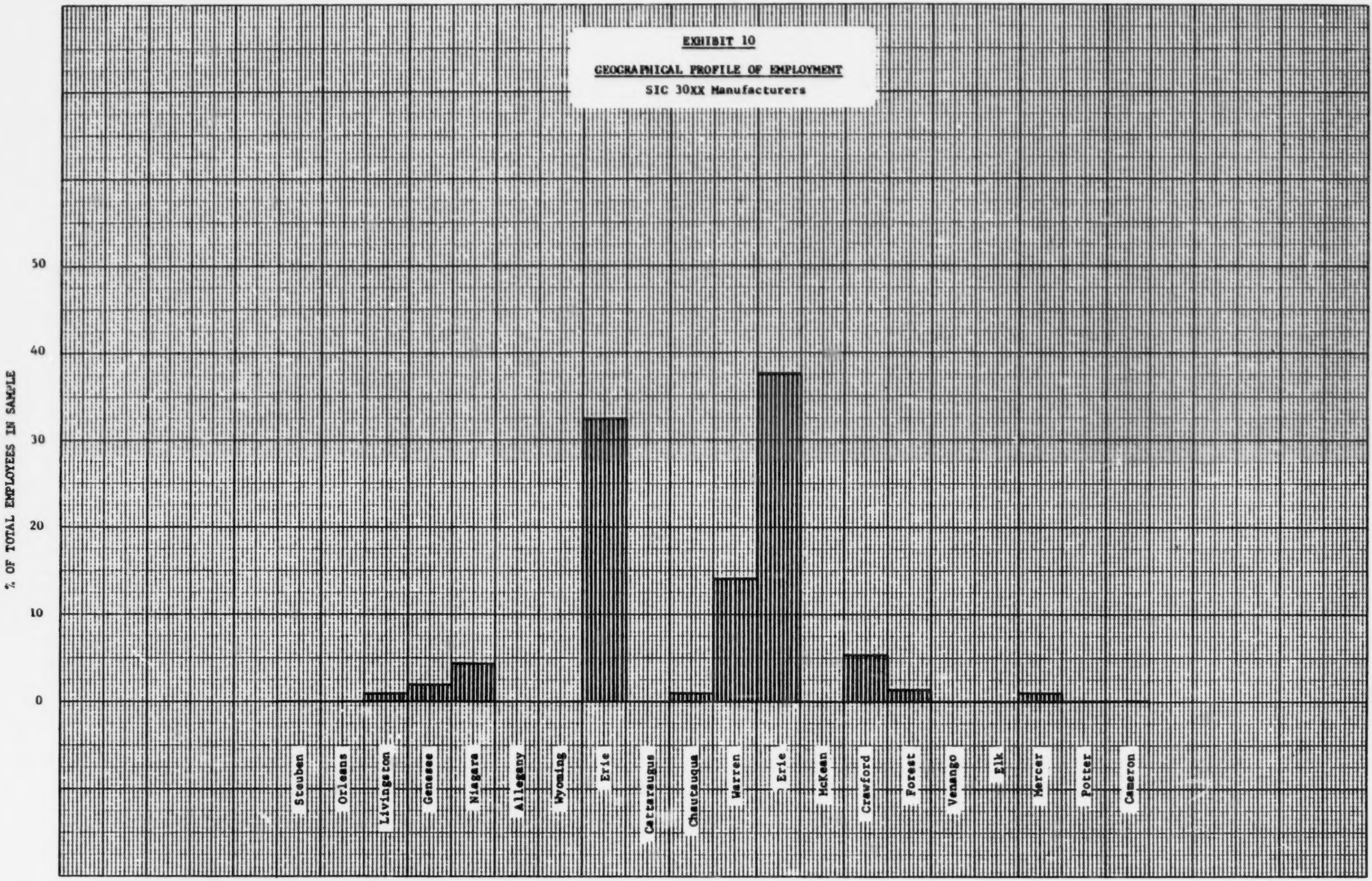
GEOGRAPHICAL PROFILE OF EMPLOYMENT

SIC 26XX Manufacturers

EXHIBIT 10

GEOGRAPHICAL PROFILE OF EMPLOYMENT

SIC 30XX Manufacturers



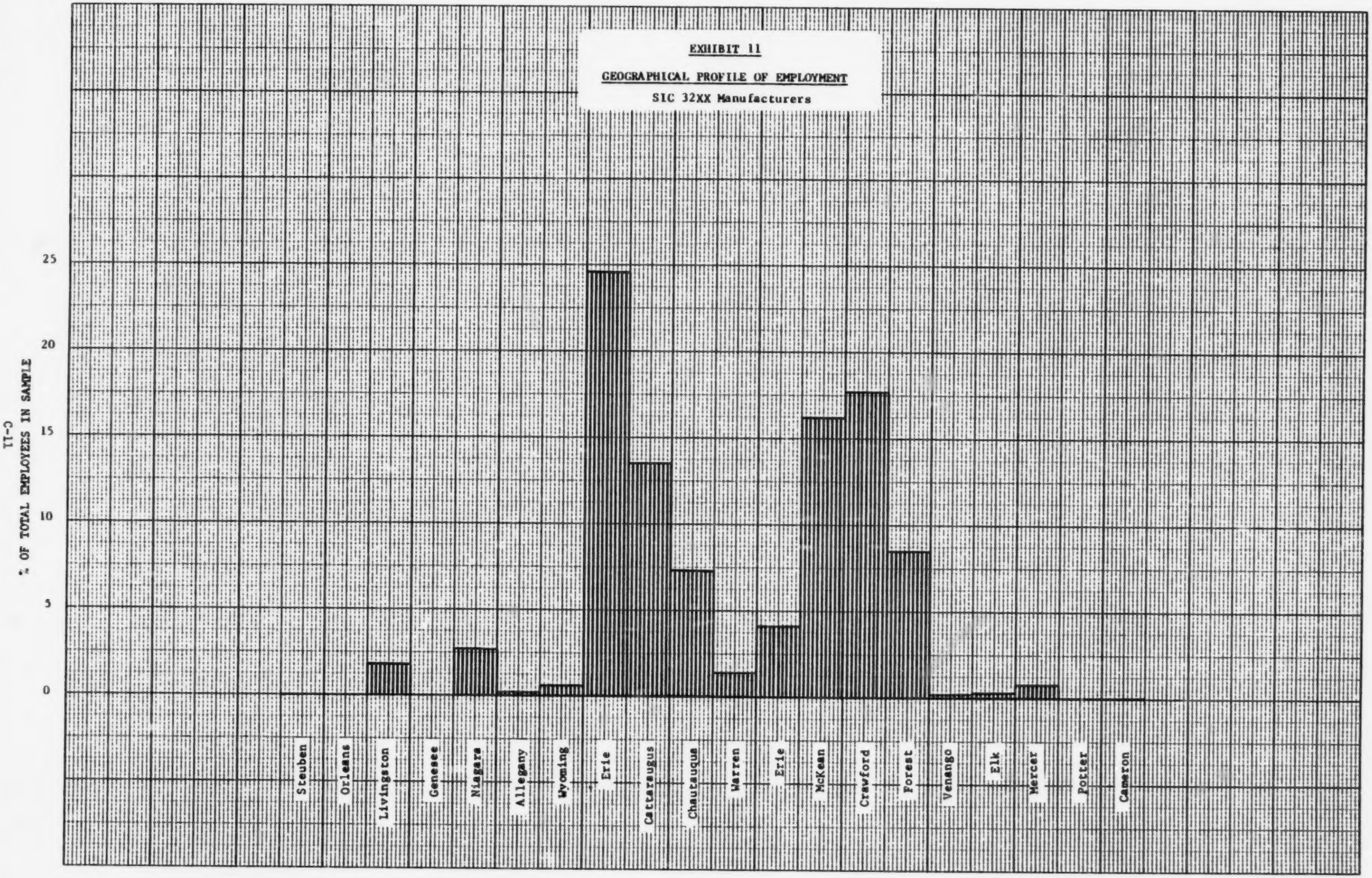


EXHIBIT 11

GEOGRAPHICAL PROFILE OF EMPLOYMENT

SIC 32XX Manufacturers

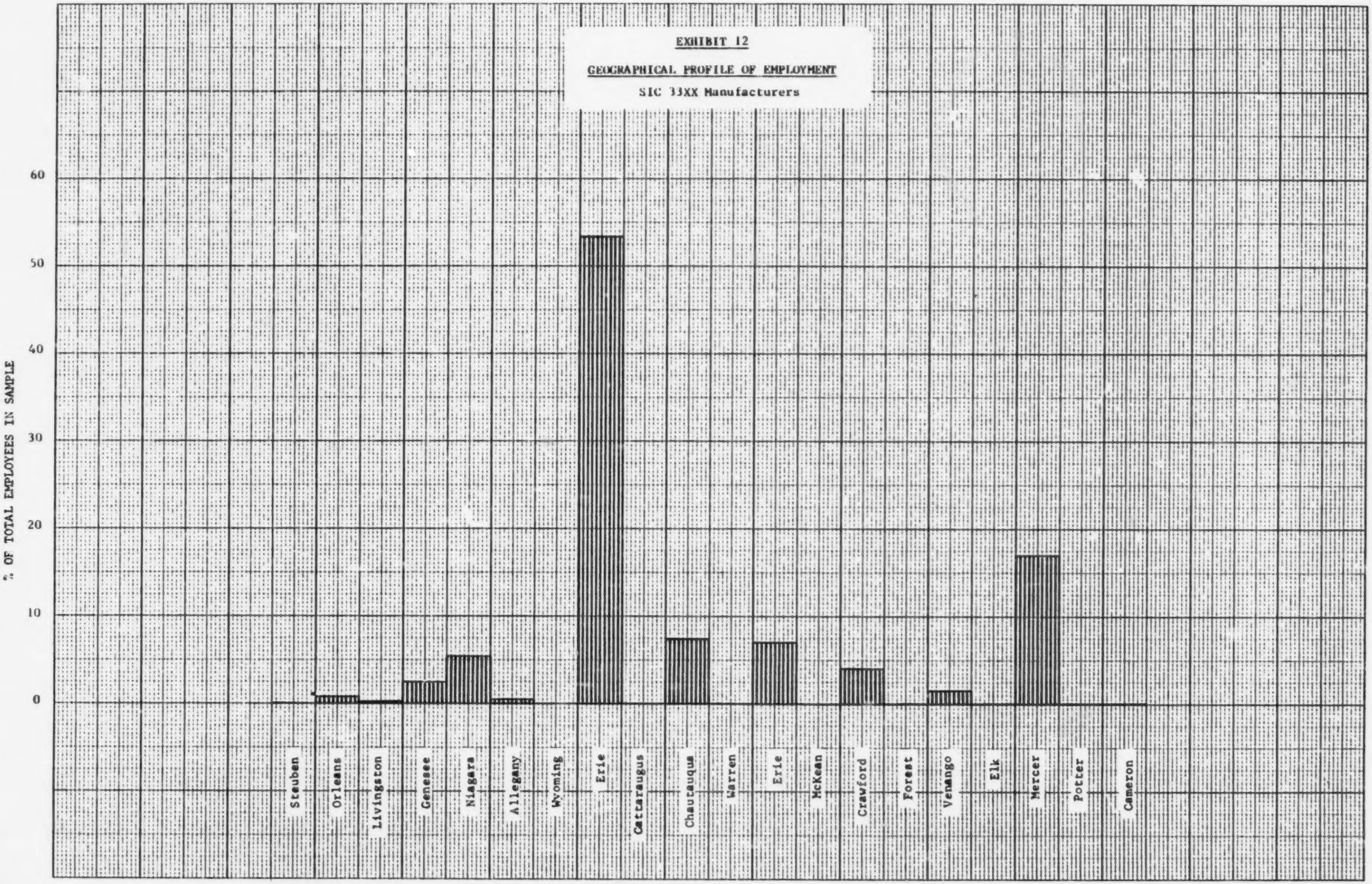


EXHIBIT 12

GEOGRAPHICAL PROFILE OF EMPLOYMENT

SIC 33XX Manufacturers

EXHIBIT 13

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Survey of Manufacturers - Content of Cover Letter

Chautauqua County, New York
Solid Wastes - Resources
Recovery Investigation

Gentlemen:

Chautauqua County has recently retained the engineering firm of Gilbert Associates, Inc. to conduct a county-wide solid wastes resource recovery investigation. Alternative solid waste processing systems will be evaluated which segregate and/or prepare mixed solid wastes into constituents which would be available as recovered materials for sale and re-use, i.e., ferrous and non-ferrous metals, glass, corrugated paper, etc.

After an initial screening process, it appears that your company has the potential for using materials which would be recovered from a solid waste processing/resource recovery facility. Integral with our investigations of the technical feasibility of alternative processing systems is the interest and need of private industry to use recovered materials which would be available from such facilities. We are therefore asking for your assistance in this endeavor which offers the potential to satisfactorily resolve the problem of solid waste disposal and concurrently make available to private industry economically attractive new origins of material. Since we are in the initial stages of our investigations we are at this time principally interested in ascertaining your company's need for materials which would be recovered from a solid waste resource recovery system to be located in Chautauqua County. To facilitate an indication of your interests and needs with respect to recovered waste constituents, we have enclosed a survey form for your responses. The information provided by companies such as yours will have a direct influence on the results of our feasibility investigations.

EXHIBIT 13

Page 2 of 2

As our investigation proceeds and if it appears that you would in fact have a sufficient demand for recovered solid waste constituents, we shall contact you for more detailed information.

Thank you for your cooperation and assistance.

Very truly yours

JOHN LUENSMAN
Planning Director
Chautauqua County

Enclosure

EXHIBIT 14

SOLID WASTE RESOURCE RECOVERY INVESTIGATION

Chautauqua County
New York

June 1975

Company Name ______________________________

Address ______________________________

____

Contact:

Name and Title ______________________________

Phone No. ______________________________

Nature of Business ______________________________

1.a. Does your firm presently use any secondary materials in its manufacturing process? Yes ______ No ______

b. If yes, what materials are used? (Please indicate)

	Tons/Year
Ferrous Metals	________
Aluminum	________
Other Non-Ferrous	________
Waste Paper	________
Corrugated	________
Cullet (Glass)	________
	________
	________
Rubber	________
Textiles	________
Plastics	________
Other	

c. What are the sources of recovered waste materials you now use?

Company's own manufacturing process ________________
Secondary Materials Dealers/Brokers ________________
Charitable/Civic Organizations ____________________
Other (please specify) _________________________

2. Would your company consider using new origins of non-virgin materials (that material recovered from solid waste) assuming it were available in a consistent quality and is economically attractive:

a. In addition to present supply of virgin and/or secondary materials?

Yes ______ No ______

b. As a partial/total replacement of present virgin materials?

Yes ______ No ______

3. If the answers to 2(a) and/or 2(b) are yes, please indicate the materials you would be interested in purchasing and the approximate quantity:

Material	Quantity (Tons/Year)

4. Please provide your comments regarding reasons such as technical restrictions which either preclude or limit your company's use of secondary materials or additional quantities thereof.

____
____
____
____
____
____
____

5. To assist us in determining the extent of refinement necessary and the form in which material must be prepared prior to shipment, please attach the specifications to which recovered materials would have to conform.

EXHIBIT 15

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Survey of Secondary Material Dealers

LETTER OF INQUIRY

Gentlemen:

Chautauqua County, New York has recently retained the engineering firm of Gilbert Associates, Inc. to conduct a county-wide solid waste resource recovery analysis. Alternate solid waste processing systems are being evaluated which will segregate and/or prepare mixed solid wastes into constituents which would be available as recovered materials for sale and re-use; i.e., ferrous and non-ferrous metals, glass, corrugated, paper, etc.

At this stage of our investigation we are primarily interested in identifying those secondary materials dealers in Chautauqua County and vicinity who might consider long term purchases of various components of municipal solid wastes. Attached for your consideration is a brief description of the types of solid waste materials which would be made available for sale along with estimates of the annual tonnages which would be generated by facilities within Chautauqua County.

Considering the nature of your business and your knowledge of the economic potential of various secondary materials, we believe your views regarding such materials are critical in arriving at a realistic assessment of the long term marketability of various recovered municipal wastes. As such, any comments you may have regarding material specifications, quantities and long term pricing would be greatly appreciated.

Thank you for your assistance and cooperation in this project.

Sincerely yours,

EXHIBIT 16

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Response to Survey of Manufacturers

COUNTY	22XX		26XX		30XX		32XX		33XX		TOTAL		%
	Mailed	Returned	Mailed	Returned	Mailed	Returned	Mailed	Returned	Mailed	Returned	Mailed	Returned	RETURNED
Chautauqua, N. Y.	2	2	1	1	-	-	4	2	10	5	17	10	58.8
Cattaraugus, N.Y.	-	-	1	-	-	-	2	-	-	-	3	-	-
Erie, N. Y.	1	-	8	3	4	1	4	2	15	1	32	7	21.9
Wyoming, N. Y.	-	-	-	-	-	-	-	-	-	-	-	-	-
Allegany, N. Y.	-	-	-	-	-	-	-	-	1	-	1	-	-
Niagara, N. Y.	1	-	4	3	3	-	-	-	5	3	13	6	46.2
Genesee, N. Y.	-	-	1	-	-	-	-	-	3	-	4	-	-
Livingston, N.Y.	-	-	-	-	1	-	1	1	-	-	2	1	50.0
Orleans, N. Y.	-	-	-	-	-	-	-	-	-	-	-	-	-
Steuben, N. Y.	-	-	-	-	-	-	1	-	-	-	1	-	-
Total - New York	4	2	15	7	8	1	12	5	34	9	73	24	32.9
Warren, PA	-	-	-	-	1	1	2	2	-	-	3	3	100.0
Erie, PA	-	-	3	1	14	2	2	1	10	4	29	8	27.6
McKean, PA	-	-	1	-	-	-	2	-	-	-	3	-	-
Crawford, PA	-	-	-	-	2	-	1	-	3	-	6	-	-
Forest, PA	-	-	-	-	1	-	1	1	-	-	2	1	50.0
Venango, PA	-	-	-	-	1	1	-	-	3	-	4	1	25.0
Elk, PA	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercer, PA	-	-	-	-	1	-	-	-	4	1	5	1	20.0
Potter, PA	-	-	-	-	-	-	-	-	-	-	-	-	-
Cameron, PA	-	-	-	-	-	-	-	-	-	-	-	-	-
Total - Pennsylvania	-	-	4	1	20	4	8	4	20	5	52	14	26.9
Unknowns				1						1		2	
Total - All Counties	4	2	19	9	28	5	20	9	54	15	125	40	32.0
% Returned	50.0		47.4		17.9		45.0		27.8		32.0		

EXHIBIT 17

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Survey of Manufacturers' Results

COMPANY NAME	SIC CODE	COUNTY	NATURE OF BUSINESS	RESPONSE TO QUESTION 1a	SECONDARY MATERIALS PRESENTLY USED	QUANTITY TONS/YEAR	SOURCE OF SECONDARY MATERIALS PRESENTLY USED	RESPONSE TO QUESTIONS 2a.	RESPONSE TO QUESTIONS 2b.	MATERIALS	QUANTITY TONS/YEAR	MANUFACTURERS' COMMENTS (See Note No.)
Mundane Corporation	22	Chautauqua		Yes	Sisal, Rope Lashings, Strings, Bag Cuttings, Cotton, Nylon, Dacron, Orlon							(1)
Sanitary Wiping Cloth Co., Inc.	22	Chautauqua	Manufacture of Wiping Cloths	Yes	Mixed Rags	20,000	Charitable/Civic Orgs. Mixed Rag Graders	Yes	Yes	Clean Mixed Rags	Open	
Jamestown Container Corp	26	Chautauqua	Manufacturer of Corrugated Shipping Containers									(2)
Buffalo Containers, Inc.	26	Erie, N.Y.	Corrugated Paper Products	Yes	Waste Paper, Corrugated	Unknown	Secondary Material Dealers Direct Mill Contracts					(3)
Continental Can Company, Inc.	26	Erie, N.Y.	Fibre Drum Manufacturer	No				No	No			
Gagner Folding Box Corporation	26	Erie, N.Y.	Manufacture - Folding Cartons	No								
Gorson Manufacturing Company	26	Niagara	Converter Folding Cartons	No								
Lawless Container Corporation	26	Niagara	Corrugated Containers	No				No	No			
The Upson Company	26	Niagara	Fiberboard Manufacturer	Yes	Waste Paper Corrugated	60 2	Secondary Material Dealers		Yes	Secondary Fibers	30	
Inland Container Corporation	26	Erie, PA	Manufacture of Corrugated Boxes	Yes	Waste Paper, Corrugated	Unknown	Company's Own Process	Yes	Yes	Containerboard, Corrugated Medium		(4)
Unknown	26	Unknown	Unknown	Yes	Corrugated	250	Secondary Material Dealers					(5)
Dunlop Tire & Rubber Company	30	Erie, PA	Tires and Sporting Goods	Yes	Rubber	250	Secondary Material Dealers	Yes	Yes	Reclaimed Tires, Reprocessed Scrap Rubber	Open	(6)
Loranger Plastics Corporation	30	Warren	Plastic Molder	No								
Continental Rubber Works	30	Erie, PA	Manufacturer of Industrial Rubber Products	No				No	No			(7)
Lord Kinematics	30	Erie, PA	Bonded Rubber to Metal Assemblies	No				No	No			(8)
Shaw Industries, Inc.	30	Venango	Molds for Plastic	No				No	No			
Chautauqua Brick Co., Inc.	32	Chautauqua	Sale of Builder's Supplies									(9)
Falconer Plate Glass Corporation	32	Chautauqua	Mirror Manufacturer	Yes	Newsprint	Unknown	Local Newspaper		Yes	Corrugated	Unknown	
Erie Scientific	32	Erie, N.Y.	Manufacture Microscope Slides	No								
Standard Mirror Co., Inc.	32	Erie, N.Y.	Automotive Mirror Manufacture	No				No	No			(10)
Lakeland Concrete Products, Inc.	32	Livingston	Precast Concrete Vaults	No				No	No			
GTE Sylvania, Inc.	32	Warren	Manufacturing	Yes	Cullet (Glass)	3,500	Company's Own Process Secondary Material Dealers	Yes	Yes	Cullet (Glass)	1000-2000	(11)
Warren Concrete Products, Inc.	32	Warren	Manufacture Concrete Septic Tanks	No								(12)
Top Roc Precast Corporation	32	Erie, PA	Precast-Prestressed Concrete	No				No	No			
Glass Containers Corporation	32	Forest	Manufacture Glass Containers	Yes	Cullet (Glass)	50,000	Company's Own Process Secondary Material Dealers Charitable/Civic Orgs. Resource Recovery Systems		Yes	Cullet Flint (Clear) Cullet Amber Cullet Green	145,000 50,000 30,000	(13)
Allegheny Ludlum Steel Corp.	33	Chautauqua	Alloy Steel Bars and Wire	No				No	No			(14)
Falconer Metal Specialties Co., Inc.	33	Chautauqua	Zinc & Aluminum Die Cast Manufacture	No				No	No			
Jamestown Bronze Works, Inc.	33	Chautauqua	Non-Ferrous Foundry & Machine Shop	Yes	Aluminum Other Non-Ferrous	10 58	Refined and Purchased From Smelter	No	No			(15)
Bublin Steel Company	33	Chautauqua	Electric Furnace-Continuous Casting Billets	Yes	Ferrous Metals	95,000	Secondary Material Dealers	Yes		Ferrous Scrap	20,000	(16)
Vac Air Alloy Corporation	33	Chautauqua	High Temp. Alloy Scrap Processing	Yes	Nickel, Cobalt, Titanium	12,500	Secondary Material Dealers	N/A	N/A			
Republic Steel Corporation	33	Erie, N.Y.	Production of Steel	Yes	Ferrous Metals	Variable	Company's Own Process Secondary Material Dealers	No	Yes	Ferrous Scrap Similar to #1 Heavy Melt Grade	Variable	(17)
Dussault Foundry Corp.	33	Niagara	Grey and Ductile Iron Foundry	Yes	Ferrous Metals	2,500	Company's Own Process Secondary Material Dealers	Yes	Yes	Ferrous Scrap	1,700	(18)
Frontier Bronze Corporation	33	Niagara	Non-Ferrous Foundry	Yes	Aluminum Other Non-Ferrous	Unknown Unknown	Secondary Material Dealers	No	Yes	Non-Ferrous Alloyed Ingots (Bronze)	500	(19)
Simonds Steel	33	Niagara	Special Metals	Yes	Ferrous Metals	1000-2000	Company's Own Process Secondary Material Dealers	Yes	No	Iron Scrap		(20)
The Electric Materials Co.	33	Erie, PA	Copper Castings/Forging/Mill	Yes	Copper	Unknown	Company's Own Process					(21)
Erie Casting Company	33	Erie, PA	Foundry	Yes	Ferrous Metals	700	Secondary Material Dealers	No	No			(22)
Lake Shore Pattern Works, Inc.	33	Erie, PA	Aluminum Architectural Products	Yes	Aluminum	60	Company's Own Process Secondary Material Dealers	No	No			(23)
Urick Foundry Company	33	Erie, PA	Foundry	Yes	Ferrous Metals	2.5×10^6	Secondary Material Dealers	Yes	Yes	Mild Steel (No Alloys) Grey Cast Iron	1.5×10^6 2.0×10^6	(24)
Sharon Steel Corporation	33	Mercer, PA	Basic Steel Manufacturer	Yes	Ferrous Metals	465,000	Company's Own Process Secondary Material Dealers	Yes	Yes	Ferrous Scrap	5000-6000	(25)

EXHIBIT 18

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Manufacturers' Comments

NOTE
NUMBER

(1) The Mundane Corporation - Letter from the Mundane Corporation to the Chautauqua County, Department of Planning and Development, July 2, 1975:

"Gentlemen:

With reference to your enclosed inquiry regarding solid waste recovery, we are currently using four to five million pounds of Sisal (in virgin form), Rope Lashings, Strings, Bag Cuttings, Cotton, Nylon, Dacron, and Orlon per year.

However, we have found from past experience, that to use any form of recycled material we have problems.

Most of our finished products are one of the ingredients that go into the making of plastics. Any contamination (i.e., oil, grease, paint, etc.) will spoil the end-product.

Also due to the fact that there are so many synthetic materials being used today, that we must buy only the pure materials.

We have tried sorting our various materials, but due to lack of knowledge by the help, and the high cost of labor, we have not found it profitable.

Cordially,

The Mundane Corporation"

(2) Jamestown Container Corporation

"Although we are a corrugated fiber board manufacturer, we are not equipped to rework and process secondary material, such as used corrugated.

However, there is a market for used corrugated material and if you are interested, we can provide you with the name of the company in Buffalo, New York who presently buys our corrugated waste."

(3) Buffalo Containers, Inc.

With respect to waste paper and corrugated, Buffalo Container states, "of no value to us unless reconstituted at papermill."

EXHIBIT 18

Page 2

NOTE NUMBER

(4) **Inland Container Corporation**

"The control and purchase as well as commitment to usage is exercised only at corporate headquarters in Indianapolis, Indiana and is dependent upon our own integrated supplies."

(5) **Unknown**

"Usage is dropping off and we expect to stop using this material, too many quality problems."

(6) **Dunlop Tire & Rubber Company**

"Use of secondary materials is based on their ability to maintain required performance consistently. Material usage is determined by performance requirements; rather than performance levels being adjusted to materials used."

(7) **Continental Rubber Works**

"We are a custom fabricator of molded and extruded rubber parts and industrial hose. Most of the parts manufactured are required to meet individual specifications, which result in the use of a wide selection of raw materials in limited quantities of each, thereby reducing the possibility of interest in any significant quantity of secondary raw material."

(8) **Lord Kinematics**

"Our vibration control systems require close tolerances to meet the applications. Quality requirements cannot be met utilizing non-virgin materials."

(9) **Chautauqua Brick Company, Inc.**

Firm does no manufacturing.

(10) **Standard Mirror Company, Inc.**

" We are limited by customer specifications on material vendors as well as the material content and in most cases performance requirements of the end product preclude use of recovered materials which probably contain some source of contamination or variance from virgin material content."

(11) **GTE Sylvania, Inc.**

Specifications provided by GTE Sylvania, Inc.:

EXHIBIT 18

Page 3

NOTE NUMBER

(11) SODA-LIME GLASS CULLET

I. Chemistry

		PERCENT
A.	Silica (SiO_2)	69 - 74
B.	Soda (Na_2O)	13 - 17
C.	Potassia (K_2O)	
D.	Lime (CaO)	6 - 10
E.	Magnesia (MgO)	
F.	Boric Oxide (B_2O_3)	0 - 2
G.	Others	0 - 5

II. Conditions

A. Cullet Form
  1. Crushed Bulbs (preferred)
  2. Crushed ribbon cullet accepted as alternate when crushed bulbs are not available.

B. Contamination - The cullet must be free from foreign objects. Only traces of organic and metallic matter are acceptable.

C. Moisture - Notification is necessary when moisture content is suspected to be greater than 2% by weight.

III. Designations

A. 0080 or 0081 (Corning)

B. R-6 (Kimble)

(12) Warren Concrete Products, Inc.

"Products manufactured by our organization primarily governed by State, government and ASTM specs making it impossible to substitute."

(13) Glass Container Corporation

"Unable to respond adequately until type of prime and subsystem known."

"I am currently Chairman of ASTM E 38.05 subcommittee which is in the process of developing specifications. It prime and subsystem known, our company can furnish specs now."

EXHIBIT 18

Page 4

NOTE
NUMBER

(14) Allegheny Ludlum Steel Corp.

"Processing within this plant does not require the use of secondary materials."

(15) Jamestown Bronze Works, Inc.

"Metals must be refined and alloyed to meet ASTM, MIL, SAE, Federal and AMS Specifications for leaded red brass, tin bronze, yellow brass, Cu-Ni, aluminum bronze, manganese bronze."

(16) Roblin Steel Company

"Ferrous scrap clean and free of tramp elements (Cu, Ni, Cr, Ti, Al, etc.)"

(17) Republic Steel Corp.

"There is a balance which must be met between the amount of "home scrap" generated and that purchased. Tonnages would vary widely depending on Cost of Competitive Material, Production, Shipping Charges, Type of Scrap Needed, etc. Ferrous scrap could be used in both B.O.F. and Blast Furnace Operations."

"Ferrous scrap in general should be as high as possible in iron content, and low in contaminents such as phosphorus, sulfur, tin and other alloying elements. Size of material would also have to be considered."

(18) Dussault Foundry Corporation

"Scrap iron - not over 80# per pc.
steel 40# each."

(19) Frontier Bronze Corporation

"We can use only about 10% secondary aluminum because of the tight specs. Tramp elements are detrimental to the mechanical properties required by customers and specs."

(20) Simonds Steel

"Our product line includes tool steels, high-nickel irons, jet-engines and nuclear alloys and other high alloy metals made to very close chemistry specifications. We presently buy only prime scrap from manufacturing operations. It is unlikely that we could use reclaimed scrap but we keep the possibility open."

With respect to specifications - "Clean, baled or cut lengths of iron scrap of known and uniform analyses with contaminents low enough to be suitable for normal electric furnace practice for high alloy materials."

NOTE NUMBER

(21) The Electric Materials Company

"Purity - commercial copper as used is 99.9+." "Only smelting and refining in large quantities are economically interesting."

(22) Erie Casting Company

"We need clean structural steel scrap."

(23) Lake Shore Pattern Works, Inc.

"The secondary aluminum we purchase has been smelted into specification ingot. We would have no use for aluminum pellets of various alloys as they may be reclaimed by you. Your principal buyer here would be people like Apex Smelting in Cleveland, Ohio!"

(24) Urick Foundry Company

"The analysis of both above materials would have to be specified and particular in order to calculate final product and achieve desired results."

Urick Foundry Company further provided the following specifications:

	Steel	Gray Iron	Sizes
Carbon	Any range	Any range	3' x 3' x 3' Bundles Max. no oil or grease permitted.
Silicon	Any range	Any range	
Phosphorus	0.07% Max.	0.07% Max.	
Sulphur	0.06% Max.	0.06% Max.	
Alloys	No or little	No or little	

(25) Sharon Steel Corporation

"Carbon scrap only - no tin, no lead coating, no aluminum or non-ferrous attachments."

EXHIBIT 19

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Correspondence Received From Secondary Material Dealers

EXHIBIT 19

WEINSTEIN CO.

DISMANTLING CONTRACTORS – NON-FERROUS METALS – STEEL – OIL & CHEM. EQUIP. – STORAGE TANKS

DIVISION OF WEB-JAMESTOWN CORPORATION

610 W. EIGHTH STREET
JAMESTOWN, N. Y. 14701
P. O. BOX 218 PHONE 664-5910

February 9, 1976

RECEIVED
FEB 10 1976
Chautauqua County Planning
Mayville, New York 14757

Chautauqua County Dept. Planning
and Development
Attention: John Luensman
Mayville, N.Y. 14757

Dear Mr. Luensman:

We have evaluated your letter of January 29, 1976 and would like to express our interest in the categories of ferrous and non-ferrous metals only. We would be interested in the steel scrap as well as the aluminum, brass and copper.

Pricing of these materials is difficult at this point in time due to the fact that we have no control over market situations. The market for these materials is rather volitile and we would be interested in pricing over a long-term only when we could know tonnages available and quality of the product.

Please contact me for any further information or any help we may be to your department. We would also like to know the location of the County's proposed operation.

Yours very truly,
Weinstein Company

Harold Weinstein
Vice President

HW:it

EXHIBIT 19

GF INC.

Chapin & Fagin Division

PROCESSORS BROKERS DEALERS – FERROUS & NON-FERROUS SCRAP

105–145 Dorothy Street • P.O. Box 246 • Buffalo, New York 14240 • Area 716 – 823-9900

RECEIVED
FEB 4 1976
Chautauqua County Planning
Mayville, New York 14757

February 3, 1976

Chautauqua County
Department of Planning & Develop.
County Office Bldg.
Mayville, New York 14757

Attn: Mr. John R. Luensman, Director

Gentlemen:

We are in receipt of your letters of January 29, 1976 addressed to both the Samuel Greenfield Div. and Chapin & Fagin Div. of GCF, Inc.

As your market survey indicates, approximately 90% of the estimated Ferrous Metals will consist of tin coated steel cans, which at the moment are unmarketable.

The estimated 22,000 tons of Non-Ferrous Metals, Ferrous Metals, glass, ashes rock, dirt and combustibles would have no value to us on a mixed basis. The Non-Ferrous, Ferrous and glass would have some value if segregated into the three classifications.

We trust that the above information will give you some idea to work on. If further information is desire please contact the undersigned.

Very truly yours,

CHAPIN AND FAGIN
DIV. OF GCF, INC.

Leo Chapin

Leo Chapin

LC/cc

EXHIBIT 19

1501 MYRTLE STREET
ERIE, PENNSYLVANIA
PHONE 456-4211

1506 WESLEY AVENUE
WESLEYVILLE, PENNA.
PHONE 899-3181

Max Silver & Sons

SCRAP IRON - METALS - AUTO PARTS
USED MACHINERY - MOTORS - SURPLUS
PLANT DISMANTLING

February [illegible] 1976

RECEIVED
FEB 1[illegible] 1976
Chautauqua County Planning
Mayville, New York 14757

Chautauqua County
Department of Planning
Court House
Mayville, New York 14757

Attention: Mr. John R. Luensman

Gentlemen:

We are interested, but would prefer to have a meeting and a clearer conception of what is involved prior to offering any proposed quotation.

Thank you for the solicitation.

Sincerely yours,

MAX SILVER & SONS

A. A. Silver

AAS/dma

EXHIBIT 19

chautauqua county
department of planning and development
county office building mayville, new york 14757 phone 716-753-7111

RECEIVED
FEB 3 1976
Chautauqua County Planning
Mayville, New York 14757

January 29, 1976

Gentlemen:

Chautauqua County, New York has retained the engineering firm of Gilbert Associates, Inc. to conduct a county-wide solid waste resource recovery analysis. Alternative solid waste processing systems are being evaluated which will segregate and/or prepare mixed solid wastes into constituents which would be available as recovered materials for sale and re-use; i.e., ferrous and non-ferrous metals, glass, corrugated paper, etc.

At this stage of our investigation we are primarily interested in identifying those secondary materials dealers in Chautauqua County and vicinity who might consider long term purchases of various recovered components of municipal solid wastes. Attached for your comments is a brief description of the types of solid waste materials which might be available for sale along with estimates of the annual tonnages.

Considering the nature of your business and your knowledge of the economic potential of various secondary materials, we believe your views regarding such materials are critical in arriving at a realistic assessment of the long term marketability of various recovered municipal wastes. As such, any comments you may have regarding material specifications and long term pricing and your interest in purchasing recovered materials would be greatly appreciated.

May we have your response to this survey no later than February 12 so that we have sufficient time to evaluate and incorporate the results in the report.

Thank you for your assistance and cooperation in this project.

Sincerely,

John R. Luensman
Director

JRL:ms
Attachment

RECEIVED
FEB 2 [illegible]

We are no longer in the scrap business

Bradford Iron & Metal Co.
Bradford, Pa. 16701

Reproduced from best available copy.

EXHIBIT 19

RECEIVED
FEB 5 1976
Chautauqua County Planning
Mayville, New York 14757

Market Survey for Recovered Solid Municipal Wastes

1. GENERAL DESCRIPTION OF SOLID WASTES: The municipal solid wastes will be shredded to a piece size ranging from 1/4 to 2 inches.

2. FERROUS METALS

ANNUAL ESTIMATED TONNAGE AVAILABLE: 4100 tons

DESCRIPTION: The predominant form of ferrous metal in municipal wastes is tin coated steel cans, approximately 90%.

3. NON-FERROUS METALS: GLASS, ASHES, ROCKS, DIRT AND COMBUSTIBLES:

ANNUAL ESTIMATED TONNAGE AVAILABLE: 22,000 tons

DESCRIPTION: This material will be a composite mixture of non ferrous metals (primarily aluminum beverage cans 30-70%), some ferrous metals, glass (primarily of beverage and food containers of mixed colors; green, amber, and clear), ashes, rocks, dirt, and some combustible material (shredded paper, etc.) suitable for further processing by interested secondary material dealers. The estimated annual quantity of each of the above constituents follows:

Non ferrous and ferrous	1300	tons
Glass	9800	tons
Ashes, rocks, dirt	1250	tons
Combustibles	9640	tons

4. WASTE PAPER, RUBBER, LEATHER, PLASTIC

It is anticipated that these waste constituents will be utilized as a supplementary fuel product, however, if there is a market for these constituents please specify the conditions and specifications under which you could accept them.

To far from our area to consider bidding.

February 2, 1976
Atlas Metal Inc.

R.S. Titchell

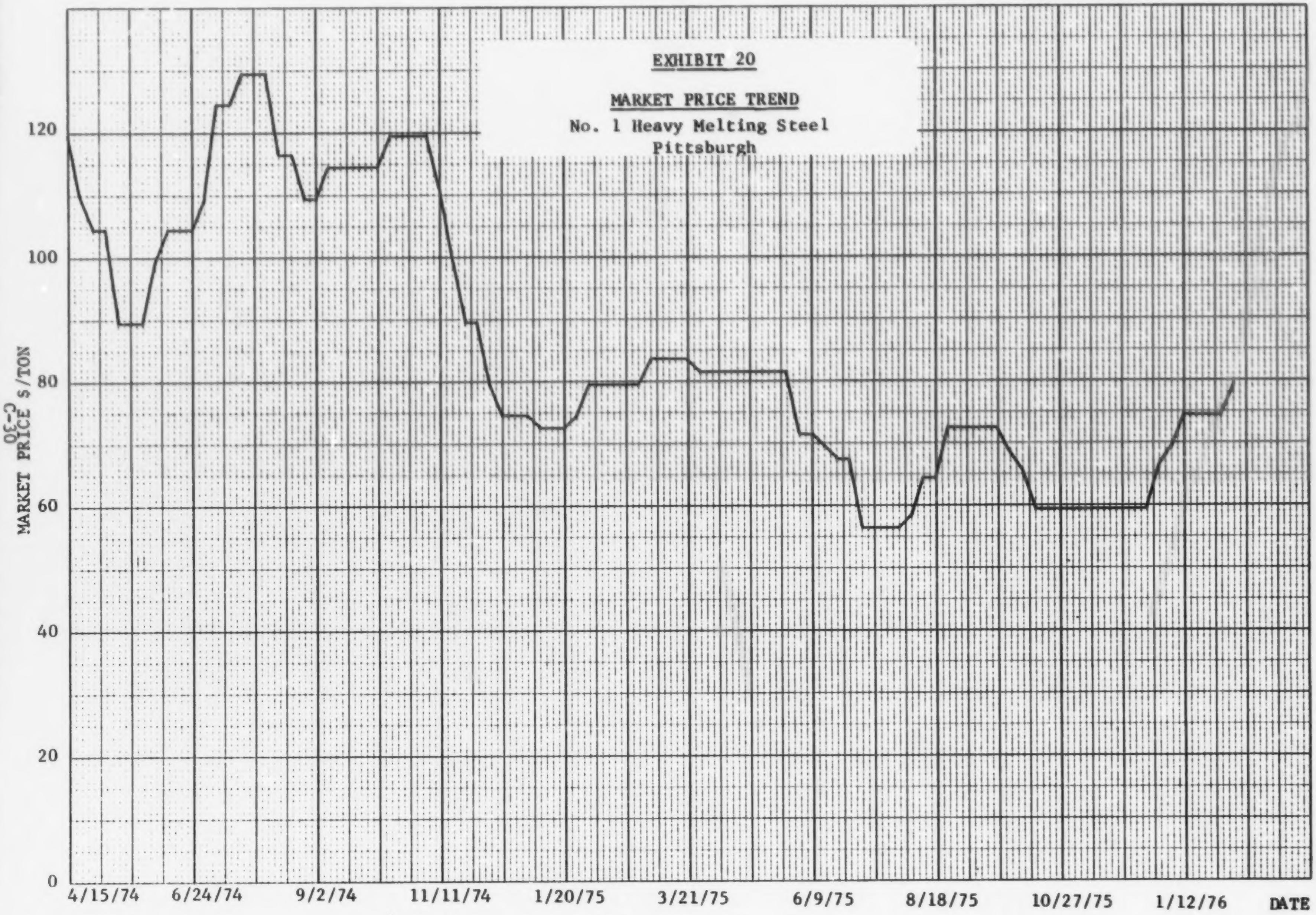


EXHIBIT 20

MARKET PRICE TREND

No. 1 Heavy Melting Steel
Pittsburgh

EXHIBIT 21

MARKET PRICE TREND

No. 1 Cupola Cast Iron
No. 2 Bundles

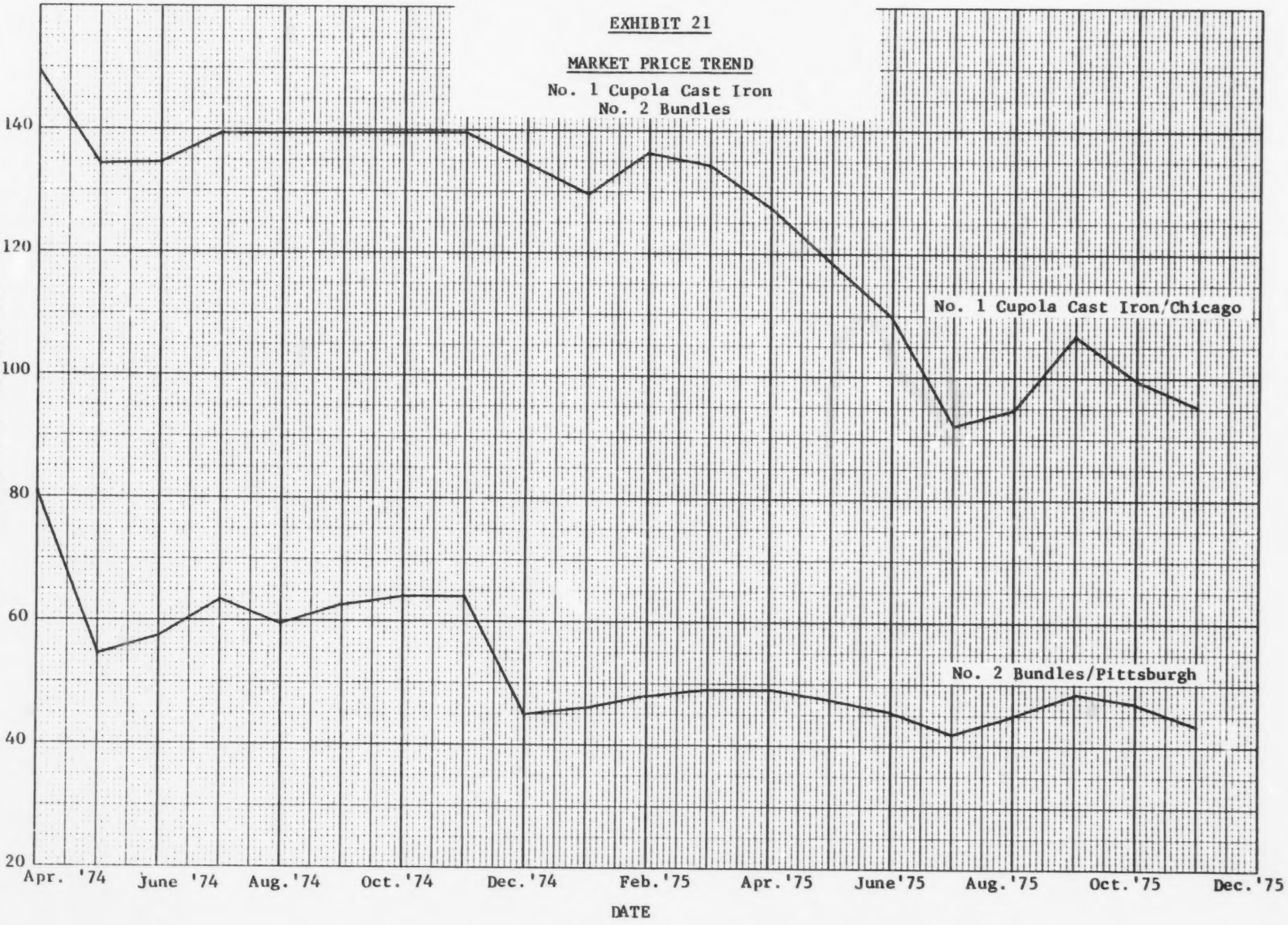


EXHIBIT 22

MARKET PRICE TREND

Aluminum - Old Sheets & Cast

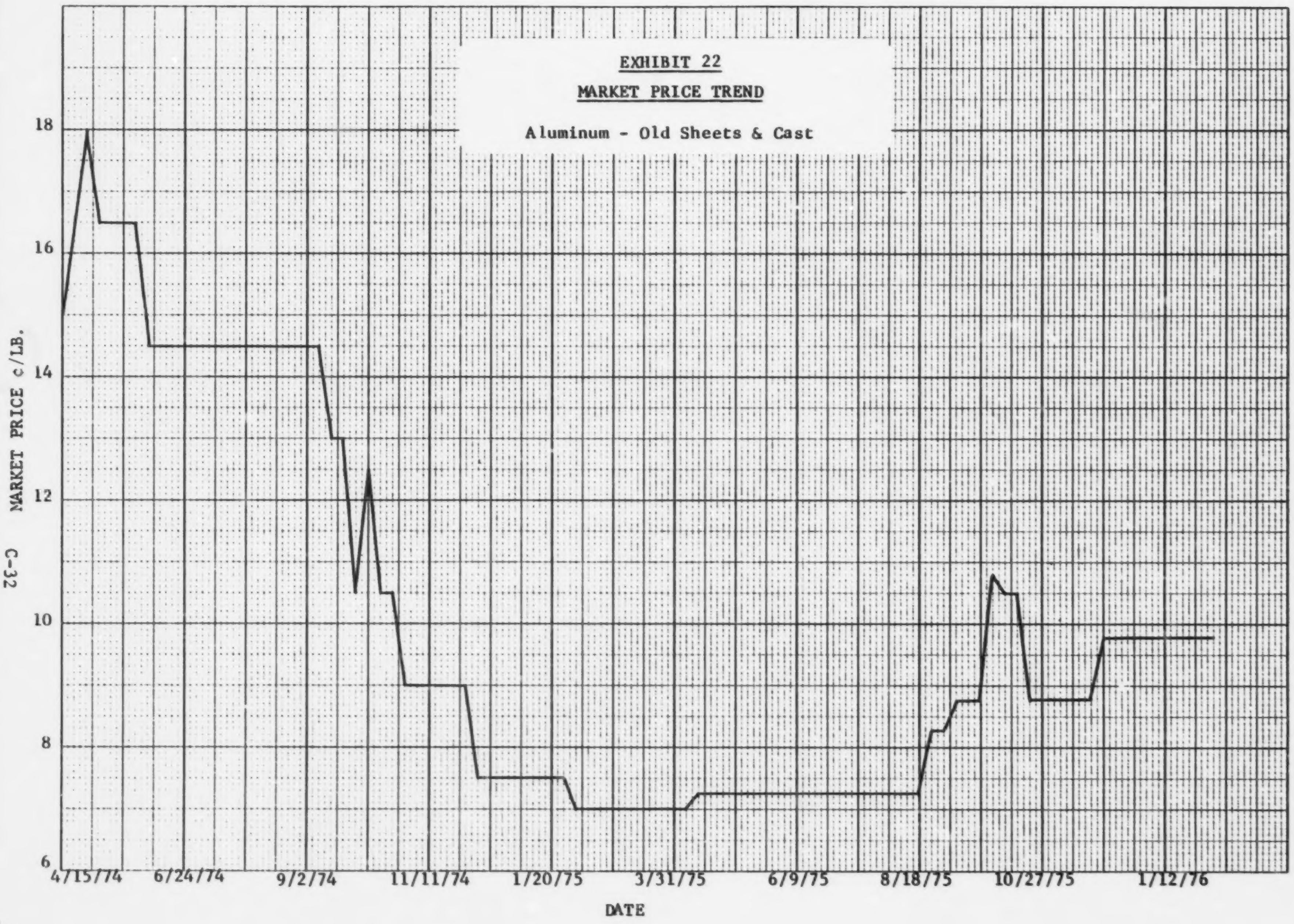


EXHIBIT 23

MARKET PRICE TREND

Clean, Heavy, Yellow Brass

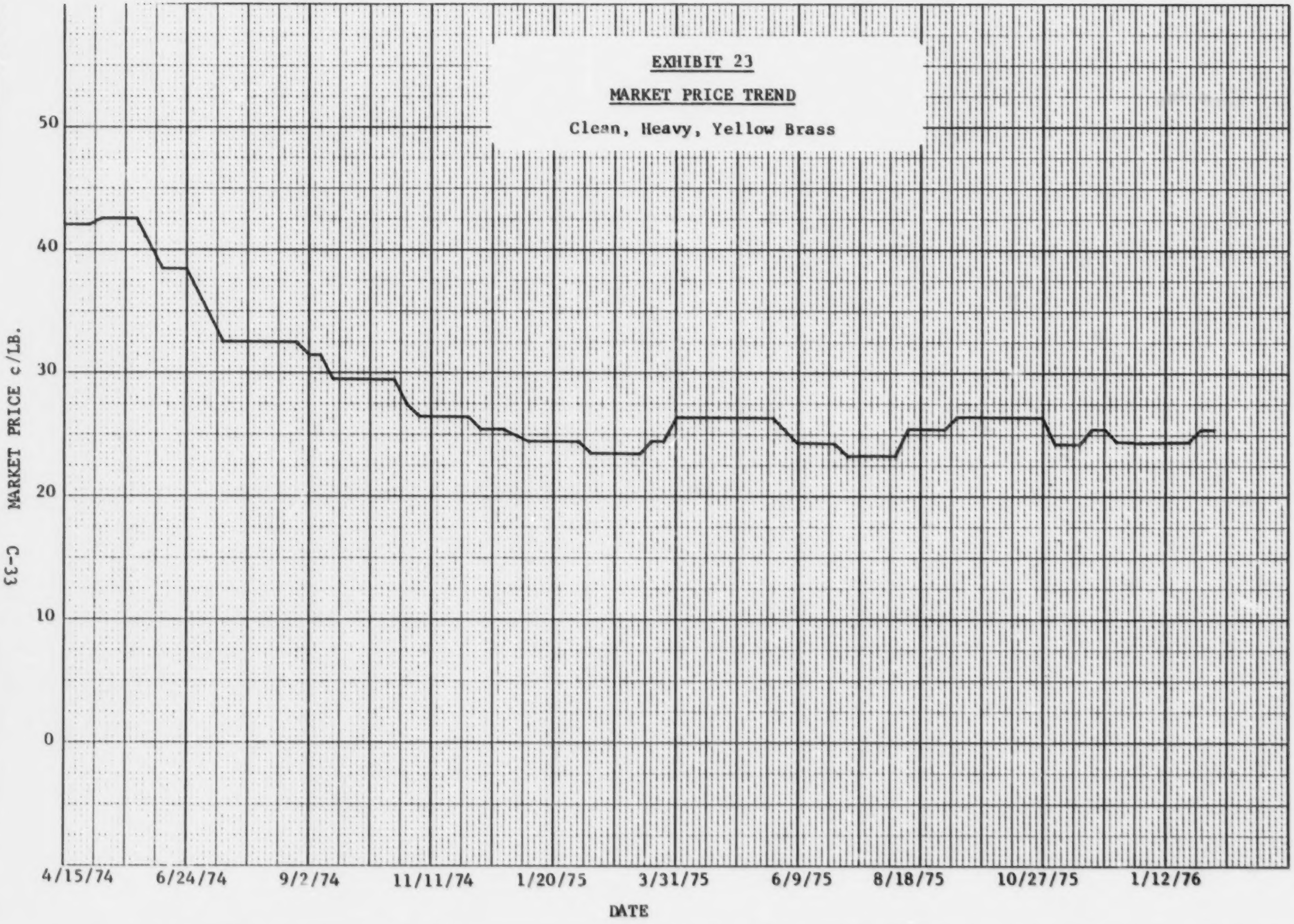


EXHIBIT 24

MARKET PRICE TREND

No. 1 Copper Wire

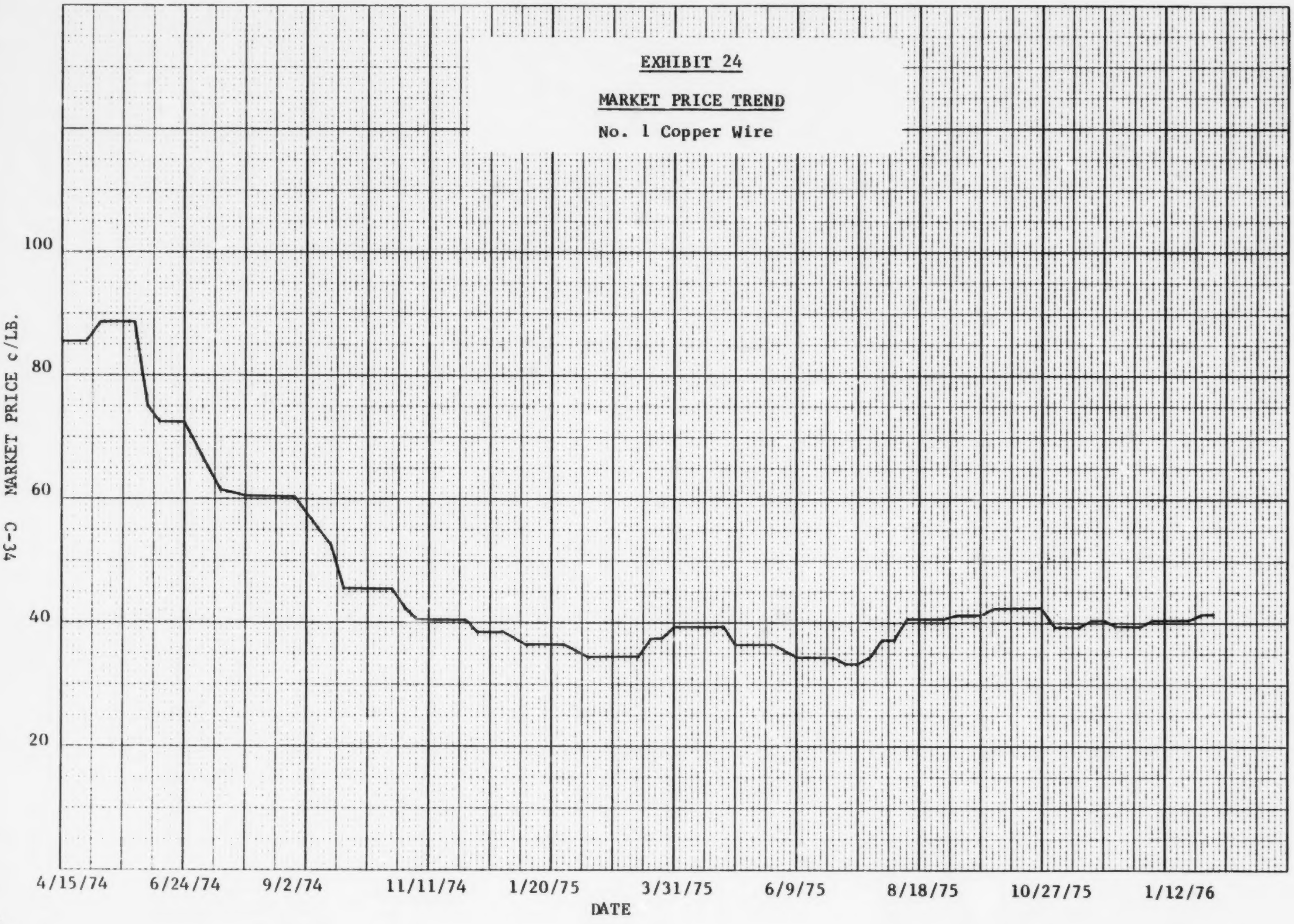


EXHIBIT 25

MARKET PRICE TREND

Waste Paper Wholesale Price

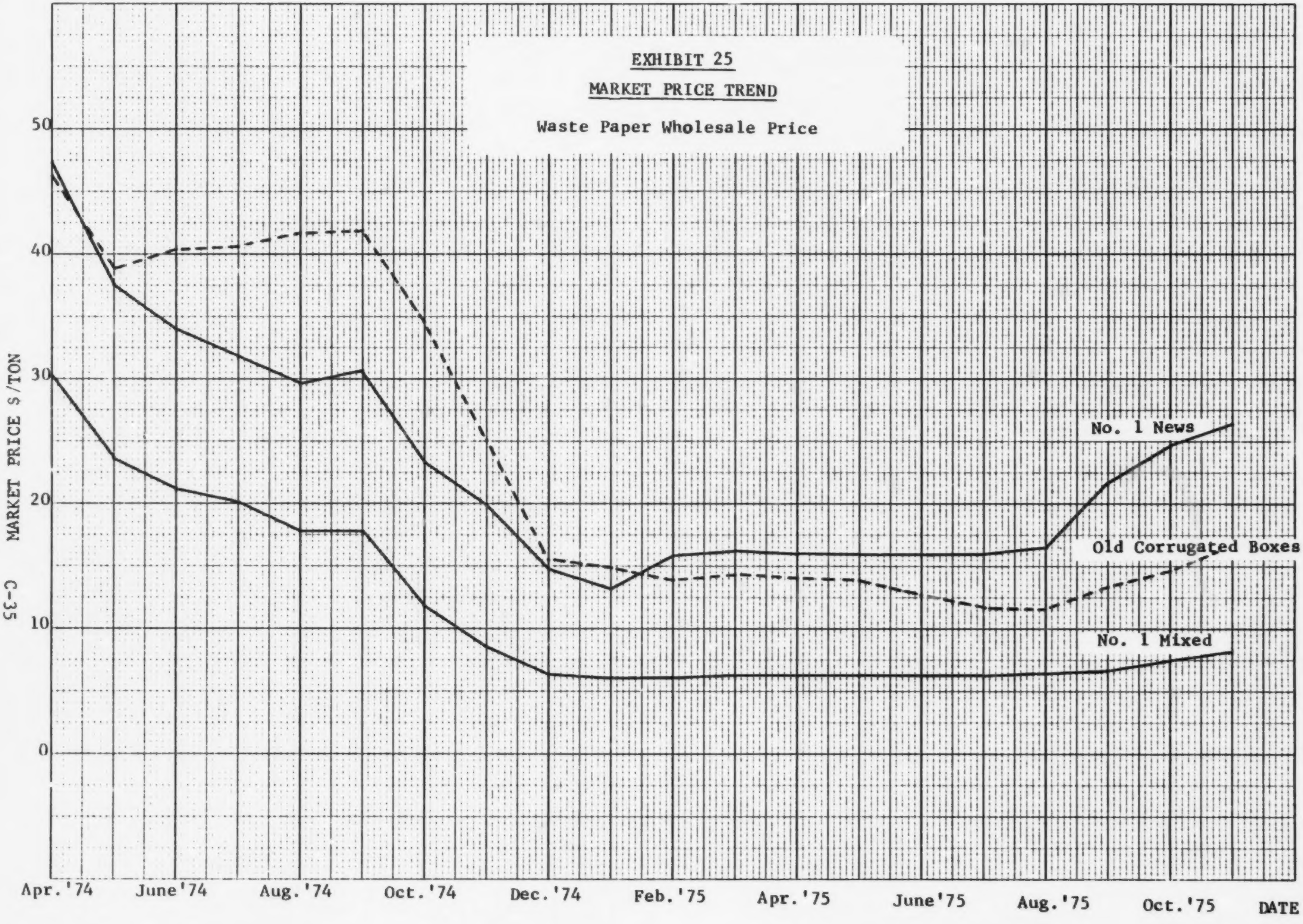


EXHIBIT 26

MARKET PRICE TREND

Reclaimed Rubber
(Whole Tire Reclamation)

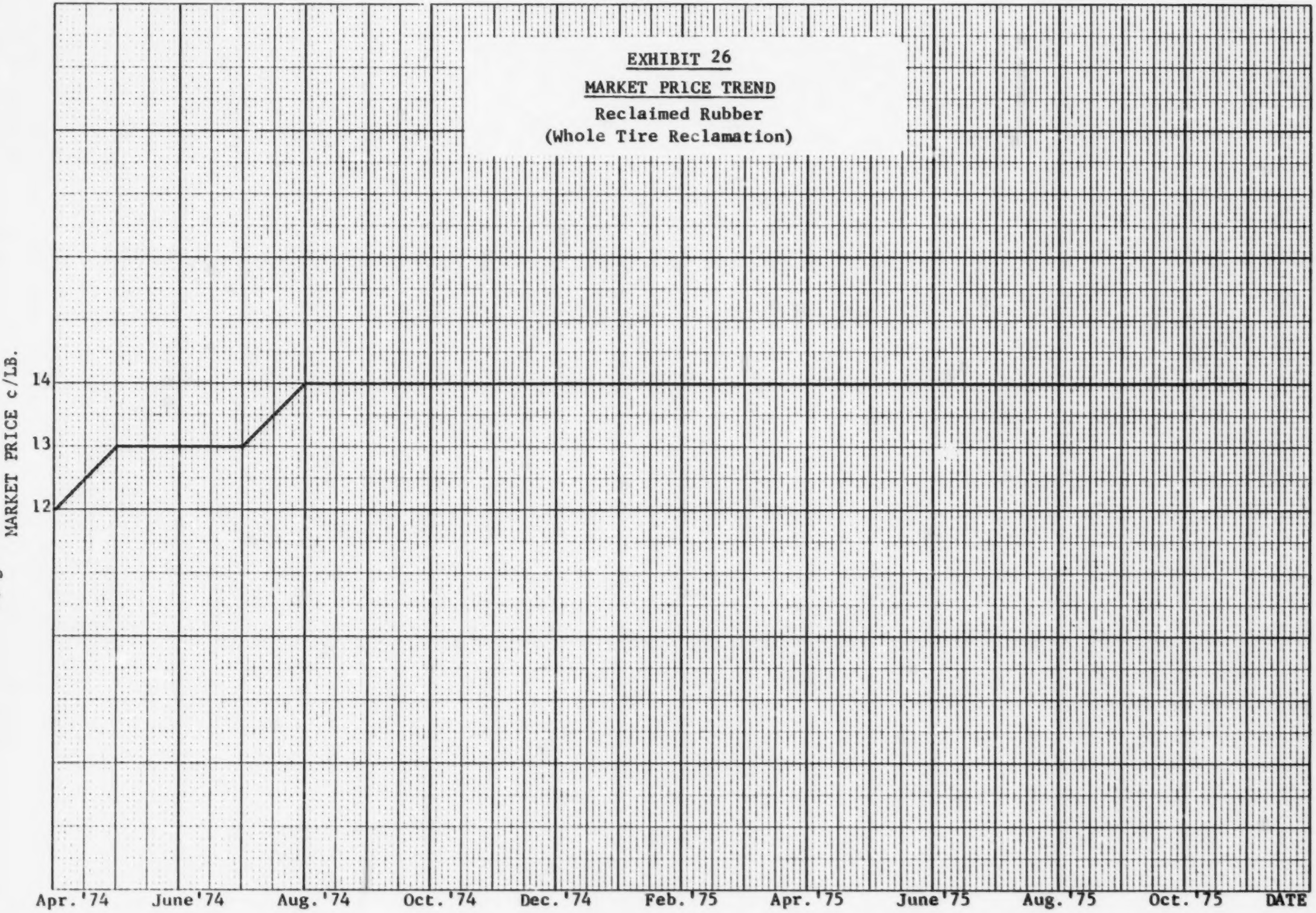


EXHIBIT 27

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Firms Meriting Further Contact

MANUFACTURERS	COUNTY
Sanitary Wiping Cloth Co., Inc.	Chautauqua, New York
The Upson Company	Niagara
Inland Container Corporation	Erie, PA
Dunlop Tire & Rubber Company	Erie, New York
Falconer Plate Glass Corporation	Chautauqua
GTE Sylvania, Inc.	Warren
Glass Containers Corporation	Forest
Roblin Steel Company	Chautauqua, New York
Republic Steel Company	Erie, New York
Dussault Foundry Corporation	Niagara
Frontier Foundry Corporation	Niagara
Simonds Steel	Niagara
Urick Foundry Company	Erie, PA
Sharon Steel Corporation	Mercer, PA

SECONDARY MATERIAL DEALERS

Weinstein Company
GF Inc., Chapin & Fagin Division
Max Silver and Sons

EXHIBIT 28

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

List of Contacts

COMPANY NAME	LOCATION	CONTACT	TITLE	TELEPHONE NUMBER
MANUFACTURERS				
The Mundane Corporation	Brocton, N.Y.	C. L. Pease	Plant Manager	716/792-9000
Sanitary Wiping Cloth Co., Inc.	Jamestown, N.Y.	David B. Davis	President	716/664-2310
Jamestown Container Corporation	Falconer, N.Y.	Joseph R. Palmeri	Vice President	665-4623
Chautauqua Brick Co., Inc.	Bemus Point, N.Y.	Arlon Shick	President	386-3825
Falconer Plate Glass Corporation	Falconer, N. Y.	Mary A. C. Johnson	Assistant to the Secretary	716/665-6422
Allegheny Ludlum Steel Corp.	Dunkirk, N.Y.	J. E. Trabits	P. E.	716/366-1000
Falconer Metal Specialties Co., Inc.	Lakewood, N.Y.	Joseph J. Bleil	Secretary-Treasurer	763-8521
Jamestown Bronze Works, Inc.	Jamestown, N.Y.	E. C. Knobloln	President	716/665-2302
Roblin Steel Company	Dunkirk, N. Y.	Gene L. Kimmel	Works Manager	366-7700
Vac Air Alloys Corporation	Frewsburg, N. Y.	E. A. Jennings	Plant Manager	716/664-4910
Buffalo Containers, Inc.	Lancaster, N. Y.		General Manager	716/683-8800
Continental Can Co., Inc.	Tonawanda, N. Y.	R. F. Seiders	Plant Manager	716/836-4200
Wagner Folding Box Corp.	Buffalo, N. Y.	James R. Winney	Vice President	716/892-3300
Dunlop Tire & Rubber Corp.	Buffalo, N. Y.	J. R. Osborne	Manager of Materials	716/877-2200
Erie Scientific Company	Buffalo, N. Y.	John Melisz	Manager of Engineering	716/854-2161
Standard Mirror Co., Inc.	Buffalo, N. Y.	Ira Goss	Vice President	716/825-3600
Republic Steel Corporation	Buffalo, N. Y.	W. G. Rader	Superintendent of Environmental Control	716/821-5410
Carson Manufacturing Co.	Lockport, N. Y.	Douglas B. Castle		716/434-8871
Lawless Container Corporation	LeRoy, N. Y.	Robert Lawless		967-8165
The Upson Company	Lockport, N. Y.	Kenneth A. Boos	Executive Vice President	716/434-8881
Dussault Foundry Corporation	Lockport, N. Y.	John D. Maxwell	President	433-3851
Frontier Bronze Company	Niagara Falls, N. Y.	W. E. Gephardt, Jr.	President	716/282-1251
Simonds Steel	Lockport, N. Y.	Charles R. Simcoe	Materials Manager	716/433-4411
Lakelands Concrete Products, Inc.	Lima, N. Y.	Richard Y. Willis	Vice President	716/624-1990
Loranger Plastics Corp.	Warren, PA	H. Spackman		814/723-8600
GTE Sylvania, Inc.	Warren, PA	W. E. Kottas		814/723-2000
Warren Concrete Products, Inc.	Warren, PA	R. J. Hourigan	Vice President	814/723-1204
Inland Container Corp.	Erie, PA	Joseph E. Terrett		814/455-9031
Continental Rubber Works	Erie, PA	R. A. Bailey	Purchasing Agent	814/453-4831
Lord Kinematics	Cambridge Springs, PA	Robert J. Siwiecki	Plant Manager	814/398-4641
Top ROC Precast Corporation	Erie, PA	Charles Heffner	Production Manager	814/838-2011
The Electric Materials Co.	North East, PA	D. L. McConaughy		725-9621
Erie Casting Company	Erie, PA	Dewitt M. Bull		454-6408
Lake Shore Pattern Works, Inc.	Erie, PA	John DeAngelo		814/456-4277
Urick Foundry Company	Erie, PA	Paul E. Davis	Metallurgist	814/454-2461
Glass Containers Corp.	Fullerton, Calif.	Pickett Scott	Assistant to President	714/879-5340
Shaw Industries, Inc.	Franklin, PA			814/432-3128
Sharon Steel Corporation	Sharon, PA	P. McGee	Assistant P.A.	216/448-4011
SECONDARY MATERIAL DEALERS				
Weinstein Company	Jamestown, N. Y.	Harold Weinstein	Vice President	664-5910
G.F., Inc. Chapin & Fagin Div.	Buffalo, N. Y.	Leo Chapin		716/823-9900
Max Silver and Sons	Erie, PA	A. A. Silver		456-4211
Atlas Metal, Inc.	Cleveland, Ohio	R. S. Titchell		

EXHIBIT 29

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

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The National Glass Budget

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Waste Trade Directory, Atlas Publishing Co.

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1971-1972 Director of Members
Institute of Scrap Iron and Steel, Inc.

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APPENDIX C-2

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Companies Included in Survey of Manufacturers

NEW YORK

CHAUTAUQUA COUNTY

SIC 22XX

Mundane Corporation
132 Central Avenue
Brocton, New York

Sanitary Wiping Cloth Co., Inc.
Bison Waste and Wiper Division
295-313 Steele Street
Jamestown, N. Y. 14701
(716/488-1149)

SIC 26XX

Jamestown Container Corporation
150 S. Phetteplace Street
Falconer, N. Y. 14733
(716/665-4623)

SIC 32XX

Chautauqua Brick Company
R. D. #1
Bemus Point, N. Y.

Falconer Plate Glass Corporation
S. Work Street
Box 41
Falconer, N. Y. 14733
(716/665-6422)

Jamestown Macadam, Inc.
Walden Avenue
Jamestown, N. Y. 14701

Jamestown Burial Vault Service and Environmental Concrete Products
584 Buffalo Street
Jamestown, N. Y. 14701

SIC 33XX

Jamestown Iron Works, Inc.
909 Allen Street Ext.
Jamestown, N. Y. 14701

Falconer Metal Specialties Co., Inc.
Winchester Road
Lakewood, N. Y. 14750
(716/763-8521)

Dunkirk Radiator Corporation
85 Middle Road
Dunkirk, N. Y. 14048

Jamestown Malleable Iron
1111 Allen Street
Jamestown, N. Y. 14701
(716/665-2630)

SIC 33XX (Continued)

Jamestown Bronze Works, Inc.
174 Hopkins Avenue
Jamestown, N. Y. 14701

Knowles-Fisher
Mechanic Street
Silver Creek, N. Y.

Vac Air Alloys Corporation
P. O. Box 477
Frewsburg, N. Y.

Foster Aluminum Alloy Products, Corp.
45 Pearl Street
Forrestville, N. Y.

Roblin Steel Company
320 South Roberts Road
Dunkirk, N. Y. 14048

Allegheny Ludlum Steel Corporation
Bar Products Division
Willowbrook Avenue - Box 152
Dunkirk, N. Y. 14048
(716/366-1000)

CATARAUGUS COUNTY

SIC 26XX

Fibercel Corporation
46 Brooklyn Street
Portville, N. Y. 14770
(716/933-8703)

SIC 32XX

American Olean Tile Co., Inc.
(Sub. of National Gypsum Co.)
103 South Clark Street
Olean, N. Y. 14760
(716/372-4300)

Hall Vault Company
63 South Seventh Street
Allegany, N. Y. 14706
(716/373-0040)

ERIE COUNTY

SIC 22XX

Buffalo Batt & Felt Corporation
3307 Walden Avenue
Depew, N. Y. 14043
(716/683-4100)

SIC 26XX

Buffalo Containers, Inc.
Central and Pearl Streets
Lancaster, N. Y. 14086
(716/683-8800)

Carton - Craft Corporation
115 Ash Street
Buffalo, N. Y. 14204
(716/853-7910)

Thoma-Warden Box Corporation
650 Clinton Street
Buffalo, N. Y. 14210
(716/854-0650)

Wagner Folding Box Corporation
1627 Broadway
Buffalo, N. Y. 14212
(716/892-3300)

SIC 26XX (Continued)

Continental Can Co., Inc.
2122 Calvin Boulevard
Tonawanda, N. Y. 14150
(716/836-4200)

Burt, F. N. Co., Inc.
(Sub. of Moore Corp. Ltd. Toronto)
P. O. Box 1089
Buffalo, N. Y. 14240
(716/684-2345)

West Virginia Pulp & Paper Co.
95 Dorothy Street - Box 547
Buffalo, N. Y. 14240
(716/822-3131)

St. Regis Container
(Div. of St. Regis Paper Co.)
1110 Military Boulevard
Buffalo, N. Y. 14217
(716/877-7800)

SIC 30XX

Buffalo Molded Plastics
3230 Union Road
Cheektowaga, N. Y. 14225
(716/683-5579)

Dunlop Tire & Rubber Corp.
Sheridan Drive & River Road
Tonawanda, N. Y. 14150
(716/877-2200)

Hewitt-Robins Division
240 Kensington Avenue
Buffalo, N. Y. 14205
(716/833-7700)

Protective Closures Co., Inc.
2150 Elmwood Avenue
Buffalo, N. Y. 14207
(716/821-5000)

SIC 32XX

Erie Scientific
693 Seneca Street
Buffalo, N. Y. 14210
(716/854-2161)

Anchor Concrete Products, Inc.
Foot of Wabash Street - Box 869
Buffalo, N. Y. 14240
(716/892-3152)

Standard Mirror Co., Inc.
141-157 Milton Street
Buffalo, N. Y. 14240
(716/825-3600)

Martin Fireproofing Corporation
2200 Military Road
Buffalo, N. Y. 14217
(716/692-3680)

SIC 33XX

Acme Steel & Malleable Iron Works
33 Chandler Street
Buffalo, N. Y. 14207
(716/876-0123)

Bethlehem Steel Corporation
3555 Lakeshore Road
Lackawanna, N. Y. 14219
(716/821-1000)

Aluminum Match Plate Corporation
Frontier Bronze Corporation
1500 Military Road
Kenmore, N. Y. 14217
(716/873-7054)

Buffalo Pipe and Foundry Corp.
91 Sawyer Avenue
Tonawanda, N. Y. 14207
(716/873-6764)

Buffalo Tank Div. (Bethlehem Steel)
Lake Avenue, P.O. Box 1912
Blasdall, N. Y. 14219
(716/821-2771)

SIC 33XX (Continued)

Donner-Hanna Coke Corporation
Abby & Mystic Streets
Buffalo, N. Y. 14220
(716/882-1600)

Pohlman Foundry Co., Inc.
205 Baitz Avenue
Buffalo, N. Y. 14206
(716/825-6900)

Shenaugo, Inc.
Fuhramann Blvd.
Buffalo, N. Y. 14203
(716/826-0100)

Pratt & Letchwork
(Div. of Dayton & Malleable Iron)
189 Tonawanda Street
Buffalo, N. Y. 14207
(716/873-0300)

Metal & Alloy Division
(Silver Creek Precision Corp.)
1875 Elmwood Avenue
Buffalo, N. Y. 14207
(716/875-5700)

Hanna Furnace Corp. (National Steel Div.)
Fuhrman Boulevard
Buffalo, N. Y. 14240
(716/823-0105)

Republic Steel Corporation
1175 S. Park Avenue
Buffalo, N. Y. 14240
(716/826-0100)

Washington Fillmore Iron Works, Inc.
153 Fillmore Ave.
Buffalo, N. Y. 14210
(716/854-8100)

Silver Creek Precision Corporation
(Metal and Alloy Division)
1875 Elmwood Avenue
Buffalo, N. Y. 14207
(716/875-5700)

National Steel Corporation
(Div. of Hanna Furnace Corp.)
Fuhramann Blvd.
Buffalo, N. Y. 14240
(716/823-0105)

ALLEGANY COUNTY

SIC 33XX

Drake Manufacturing Company
(Div. of Mailer Industries, Inc.)
Howard Street
Friendship, N. Y. 14739
(716/973-3921)

NIAGARA COUNTY

SIC 22XX

Lockport Felt
(Div. of the Carbourundum Co.)
Newfare, N. Y. 14108
(716/778-8511)

NIAGARA COUNTY

SIC 26XX

Corson Manufacturing Company
20-24 Michigan Street
Lockport, N. Y. 14094
(716/434-8871)

Lawless Container Corp.
51 Robinson St.
N. Tonawanda, N. Y. 14121
(716/692-6510)

Packaging Corp. of America
85 Grand Street
Lockport, N. Y. 14094
(716/433-3875)

Upson Company
Upson Pt., 72 Stevens St.
Lockport, N. Y. 14094
(716/434-8881)

SIC 30XX

Ferree Plastics, Inc.
180 Van Buren St.
Lockport, N. Y. 14094
(716/433-6728)

Norton Laboratories, Inc.
(Sub. of Auburn Plastics)
520 Mill Street
Lockport, N. Y. 14094
(716/433-6751)

Frontier Store Products, Inc.
Himmar Road - Box 436
Lockport, N. Y. 14094
(716/434-8817)

SIC 33XX

Airco, Inc. (Airco Alloy Division)
3801 Highland Avenue
Niagara Falls, N. Y. 14302
(716/825-1252)

Dussault Foundry Corporation
2 Washburn Street
Lockport, N. Y. 14094
(716/694-2722)

Frontier Bronze Corporation
4870 Packard Road
Niagara Falls, N. Y. 14304
(716/282-1251)

Simonds Steel Division
(Wallace-Murray Corp.)
Ohio Street
Lockport, N. Y. 14094
(716/433-4411)

Union Carbide Corporation
(Mining and Metals Division)
137 47th St. - Box 66
Niagara Falls, N. Y. 14302
(716/278-3000)

GENESEE COUNTY

SIC 26XX

Lawless Container Corporation
LeRoy Division
57 North Street
LeRoy, N. Y. 14482
(716/967-8165)

SIC 33XX

Doehler-Jarvis Division
NL Industries, Inc.
Evans St. - Box 400
Batavia, N. Y. 14482
(716/343-3000)

Rowell, E. N. Co., Inc.
1 Ellicott Street
Batavia, N. Y. 14020
(716/343-5260)

Kisiel Die Casting Works, Inc.
127 Lehigh Avenue
Batavia, N. Y. 14020
(716/343-7258)

LIVINGSTON COUNTY

SIC 30XX

Dubois Plastic Products, Inc.
(Sub. of Precise Metals & Plastics)
Rochester St.
Avon, N. Y. 14414
(716/926-8122)

SIC 32XX

Lakelands Concrete Products, Inc.
East Main Road
Lima, New York 14485
(716/624-1990)

STEUBEN COUNTY

SIC 32XX

Corning Packaging Company
(Div. of Corning Glass Works)
Riverside Plant
Corning, N. Y. 14830
(607/974-7000)

PENNSYLVANIA

WARREN COUNTY

SIC 30XX

Loranger Plastics Corp.
10-38 Clark St.
Warren, PA 16365
(814/723-8600)

SIC 32XX

GTE Sylvania, Inc. (Parts Div.)
816 Lexington Ave.
Warren, PA 16365
(814/723-2000)

Warren Concrete Products, Inc.
1911 Pennsylvania Ave., West
Warren, PA 16365
(814/723-1204)

ERIE COUNTY

SIC 26XX

Inland Container Corp.
922 Bacon St.
Erie, PA 16512
(814/455-9031)

GAF Corp. (Building Products Div.)
Foot of Sassafrers St.
P. O. Box 1128
Erie, PA 16512
(814/452-3291)

Prescotech, Inc.
859 E. 8th St.
Erie, PA 16512
(814/456-5351)

ERIE COUNTY (Continued)

SIC 30XX

Brookpark-Royalon, Inc.
(Div. of Jeannette Corp.)
100 Keystone Drive
Lake City, PA 16423
(814/774-3106)

Perry Plastics, Inc.
(Sub. of Blasius Industries)
3409 W. 14th St.
Erie, PA 16505
(814/838-1971)

Lord Kinematics (Unit of Lord Corp.)
124 Grant St.
Cambridge Springs, PA 16403
(814/456-8511)

Buffalo Molded Plastics, Inc.
1810 W. 20th St.
Erie, PA 16502
(814/455-8084)

Niagara Plastics Co.
7090 Edinboro Road
Erie, PA 16509
(814/868-3671)

Lakeland Plastic Company
1823 W. 20th St.
Erie, PA 16502
(814/453-5015)

Continental Rubber Works
(Sub. of Continental Copper & Steel
Industries, Inc)
2000 Liberty St.
Erie, PA 16512
(814/453-4831)

Zurn Industries, Inc.
Leisure Products Group
5533 Perry Highway
Erie, PA 16509
(814/864-4041)

Erie County Plastics Corp.
P. O. Box 394
1 Plastics Road
Corry, PA 16407
(814/664-4661)

Corry Rubber Corporation
405 W. Main St.
Corry, PA 16407
(814/664-4513)

Byrd Plastics, Inc.
2953 W. 12th St.
Erie, PA 16505
(814/833-9804)

Port Erie Plastics, Inc.
909 Troupe Road
Harborcreek, PA 16421
(814/899-7602)

Molded Fiber Glass Boat Co.
55 Fourth Avenue
Union City, PA 16438
(814/438-3841)

Nosco Plastics, Inc.
(White Eagle, International)
1701 Gaskell Avenue
Erie, PA 16503
(814/455-4491)

SIC 32XX

Duchini, Inc.
2400 Brendes St.
Erie, PA 16503
(814/456-7027)

Top Roc Precast Corp.
2210 Manchester Road
Erie, PA 16506
(814/838-2011)

ERIE COUNTY (Continued)

SIC 33XX

Arrow Casting Company
2645 W. 14th St.
Erie, PA 16505
(814/883-3561)

Erie Casting Company
1534 German St.
Erie, PA 16512
(814/454-6408)

Erie Malleable Iron Co.
603 W. 12th St.
Erie, PA 16501
(814/452-6431)

Electric Materials Co., The
Clay & Washington Sts.
P. O. Box 390
North East, PA 16428
(814/725-9621)

Urick Foundry Company
(Sub. of Emerson Electric Co.)
Cherry & 15th Sts.
Erie, PA 16501
(814/454-2461)

Keystone Brass Works, Inc.
944 W. 12th St.
Erie, PA 16512
(814/456-4296)

Parker White Metal Co.
P.O. Box 276 - Ridge Road
Fairview, PA 16415
(814/474-5511)

Lake Shore Pattern Works, Inc.
654 W. 19th St.
Erie, PA 16512
(814/456-4277)

Hays Fluid Controls Division
(Zurn Industries, Inc.)
801 W. 12th St.
Erie, PA 16512
(814/452-3221)

Weil Mclaim Co., Inc.
(Hydronic Division)
1631 East Avenue
Erie, PA 16512
(814/453-4626)

MCKEAN COUNTY

SIC 26XX

Hanley Company
28 Kennedy Street
Bradford, PA 16701
(814/368-3151)

SIC 32XX

Owens-Illinois, Inc.
Forest Products Corporation
Bradford, PA 16701

Pierce Glass (Div. of Indian Head Co.)
1 Glass Place
Port Allegany, PA 16743
(814/642-2521)

CRAWFORD COUNTY

SIC 30XX

Lord Kinematics
(Unit of Lord Corporation)
124 Grant Street
Cambridge Springs, PA 16403
(814/398-4641)

Rockwell International
(Plastics Operation)
E. Erie Street
Lanesville, PA 16424
(814/683-4500)

SIC 32XX

P. O. G. Industries, Inc.
Works Number 8
P. O. Box 800
Meadville, PA 16335
(814/336-4411)

SIC 33XX

Dayton Malleable, Inc.
(Meadville Division)
Box 417 - Mill St.
Meadville, PA 16335
(814/724-2600

Ohio Rubber Company
(Eagle-Picher Industry)
Water Street
Conneautville, PA 16406
(814/587-5115)

Cyclops Corporation
(Universal Cyclops Specialty Steel Div.)
701 E. Spring St.
Titusville, PA 16354
(814/827-3641)

FOREST COUNTY

SIC 30XX

Questor Juvenile Products Co.
Crator Manufacturing Division
Elm Street
Tionesta, PA 16353
(814/755-3538)

SIC 32XX

Glass Containers Corporation
535 N. Gilbert Ave. - Box 4118
Fullerton, CA. 92634
(714/879-5340)

VENANGO COUNTY

SIC 30XX

Shaw Industries, Inc.
Route 2 - Box 591
Franklin, PA 16323
(814/432-3128)

VENANGO COUNTY (Continued)

SIC 33XX

Electralloy Corporation
175 Main Street - Box 381
Oil Creek Station
Oil City, PA 16301
(814/676-1894)

Jones & Laughlin Steel Corporation
Electricweld Tube Division
363 Seneca Street
Oil City, PA 16301
(814/645-1261)

Franklin Steel
(Div. of Borge-Warner Corp.)
600 Atlantic Avenue
Franklin, PA 16323
(814/676-8511)

MERCER COUNTY

SIC 30XX

McGinnis Brothers, Inc.
P. O. Box 442
Reynolds Development
Greenville, PA 16125
(412/646-4141)

SIC 33XX

Hodge, W. S. Foundry, Inc.
Mapleton Road
Greenville, PA 16125
(412/588-4100)

Midland Ross Corporation
(Midwest Foundry Division)
700 S. Dock Street
Sharon, PA 16146
(412/346-6575)

Sharon Steel Corporation
P. O. Box 291
Sharon, PA 16146
(412/448-4011)

Shenango, Inc.
High Street
Sharpsville, PA 16150
(412/962-7820)

APPENDIX C-3

CHAUTAUQUA COUNTY - SOLID WASTE MARKET STUDY

Secondary Material Dealers Included in Mail Survey

NEW YORK

CHAUTAUQUA COUNTY

David Kranitz
220 Water
Falconer, N.Y. 14733

Davis Junk & Salvage Co.
151 Jones
Jamestown, N.Y. 14701

Frank O'Brocta Salvage
157 Willow Road
Dunkirk, New York 14048

Jamestown Iron & Metal Co., Inc.
110 Steele
Jamestown, N.Y. 14701

W. F. Politte, Inc.
P. O. Box 487
Jamestown, N.Y. 14701

A. Rubinstein & Sons, Inc.
202 W. 2nd Street
Dunkirk, N.Y. 14048

Weinstein Company
610 W. 8th
Jamestown, N.Y. 14701

ALLEGHENY COUNTY

Derby & Company, Inc.
100 Fleet Street
Pittsburgh, PA 15220

CATTARAUGUS COUNTY

Salamanca Iron & Metal Co.
164 Rochester
Salamanca, N.Y. 14779

ERIE COUNTY

Bison Waste & Wiper Corp.
339 Military Road
Buffalo, N.Y. 14240

Paul Blum Company
315 Larkin
Buffalo, N.Y. 14240

Bern Metal Company, Inc.
328 Howard Street
Buffalo, N.Y. 14240

Buffalo Waste Paper Co., Inc.
25 Hardwood
Buffalo, N.Y. 14240

GCF, Inc. (Chapin & Fagin Div.)
105-145 Dorothy St. - Box 246
Buffalo, N.Y. 14240

GCF, Inc. (Samuel Greenfield Div.)
106 Thomas Street - Box 246
Buffalo, N.Y. 14240

Hurwitz Bros. Iron & Metal Co., Inc.
P.O. Box 5- So. Park Station
Buffalo, N.Y. 14240

Keystone Waste Paper Company
605 Broadway
Buffalo, N.Y. 14240

Lancaster Iron & Metal Company
128 Central Avenue
Buffalo, N.Y. 14240

Sam Ligheter & Son
12 Cedar Street
Akron, N.Y. 14001

ERIE COUNTY (Continued)

Luria Brothers & Co., Inc.
4446 Main Street
Buffalo, N.Y. 14226

National Waste Paper & Metal Co.
139 Watson
Buffalo, N.Y. 14240

Oppenheimer Corporation
578 Exchange Street
Buffalo, N.Y. 14240

Roblin Scrap Products Company
1437 Bailey Ave. - Box 861
Buffalo, N.Y. 14240

J. Wolf, Inc.
366 Bailey Avenue
Buffalo, N.Y. 14240

B. Memel & Company
1091 Clinton
Buffalo, N.Y. 14240

Niagara Falls Metals & Minerals, Inc.
P. O. Box 225
Buffalo, N.Y. 14127

Pennsylvania Wood & Iron Company
310 Ellicott Square Building
Buffalo, N.Y. 14203

S. Shine and Sons
18 Manitoba Street
Buffalo, N.Y. 14240

NIAGARA COUNTY

Gratwick Salvage Company
843 River Road
North Tonawanda, N.Y. 14120

Rudolph Gold and Son
1009 Garden Avenue
Niagara Falls, N.Y. 14302

Waste Products Company
56th & Charles Avenue - Box 666
Niagara Falls, N.Y. 14302

North American Waste, Inc.
P.O. Box M - Bridge Station
Niagara Falls, N.Y. 14305

Schrek's Iron & Metal Company
55 Schenck
North Tonawanda, N.Y. 14120

PENNSYLVANIA

ERIE COUNTY

Asko, Inc.
901 G Daniel Baldwin Building
Erie, PA 16501

Independent Iron & Metal Corp.
235 E. 20th St - Box 883
Erie, PA 16512

Max Silver & Sons
1501 Myrtle Avenue
Erie, PA 16517

Republic Iron & Metal Co., Inc.
1140 W. 18th
Erie, PA 19601

Star Waste Products Co.
310 E. 16th
Erie, PA 16501

Erie Plastics Company
Warfel Avenue & Buffalo Road
Erie, PA 16501

Penn Iron and Metal Co., Inc.
1515 East Ave. - Box 177
Erie, PA 16512

M. P. Radov Corporation
1925 Holland
Erie, PA 16501

Sam Cohen & Sons
326 E. 18th
Erie, PA 16501

Union Iron & Metal Co.
904 E. 11th - Box 687
Erie, PA 16512

ALLEGHENY COUNTY

Pitt Metals Company
4314 Main Street
Pittsburgh, PA 15224

Steelmet, Inc.
1204 Grant Building
Pittsburgh, PA 15219

MCKEAN COUNTY

Bradford Iron & Metal Co.
Hilton Street
Bradford, PA 16701

Lovitz & Reichenbach
74 Webster
Bradford, PA 16701

WASHINGTON COUNTY

Washington Penn Plastic Co.
2833 West Chestnut Street
Washington, PA 15301

OHIO

Acme Scrap Iron & Metal Co.
P. O. Box 218
Astabula, Ohio 44004

Goldsmith & Eggleton, Inc.
2550 Gilchrist Road - Box 849
Akron, Ohio 44307

A. Schulman, Inc.
3550 West Market St.
Akron, Ohio 44313

Atlas Metals, Inc.
8550 Aetna Road
Cleveland, Ohio 44105

The River Smelting & Refining Co.
4195 Bradley Road - Box 5755
Cleveland, Ohio 44101

The Victory White Metal Co.
6100 Roland Avenue
Cleveland, Ohio 44127

The following format to be used as a cover letter for the Boiler Survey Form:

Gentlemen:

"Chautauqua County has recently retained the engineering firm of Gilbert Associates, Inc. to conduct a county wide solid waste resource recovery analysis. Alternative solid waste resource recovery processes will be evaluated as our investigations proceed. These alternative systems offer the potential to make available an economically attractive source of fuel as an alternative to oil or gas. Alternative systems under evaluation include those which make energy available either as asolid or gaseous fuel depending upon the specific process.

Although we are only in the initial stages of ascertaining the feasibility of alternative systems for possible application in Chautauqua County; part of this feasibility analysis involves ascertaining the specific energy needs of users in the county who might be compatible to using an alternative fuel source.

We would appreciate your completion of the enclosed "Boiler Plant Survey" form which will have a direct influence on the results of our feasibility investigations. As we progress in our investigations, if it appears that your interests and energy needs are such that an economically attractive alternative fuel source could be furnished to you, we shall contact you to provide you with further information.

Thank you for your assistance and cooperation in this project."

Very truly yours,

JOHN LUENSMAN
Planning Director
Chautauqua County

April 15, 1975

SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility ____________________

Location ____________________

Telephone No. ____________________

Plant Manager ____________________

Chief Engineer ____________________

	Boiler No. 1	Boiler No. 2	Boiler No 3	Boiler No. 4
Boiler Manufacturer				
Type or Class				
Start-up Date				
Steam Capacity lbs/hr				
Operating Pressure-psi				
Steam Temp. °F T T				
Feed Water Temp.				
Economizer Exit Gas Temp.				
Air Heater Exit Gas Temp.				
Design Efficiency %				
Present Fuel Used				
Stoker Type and Manufacturer				
Stoker Dimensions				
No. of Coal Pulverizers				
Manufacturer and Type of Pulverizer				
Mechanical Dust Collector				
Electrostatic Precipitator				
Average Summer Steam Load				
Average Winter Steam Load				
Type of Ash Handling Equipment				

APRIL 15, 1975

SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

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Chautauqua County Planning
Mayville, New York 14757

Owner of Facility Peter Cooper Corporations
Location Gowanda, New York
Telephone No. 532-3344
Plant Manager
Chief Engineer Richard K Gunnell

	Boiler No. 1	~~Boiler No. 2~~	~~Boiler No. 3~~	~~Boiler No. 4~~
Boiler Manufacturer	Kewanee Boiler Corporation			
Type or Class	Scotch Marine 3 pass, fire tube			
Start-up Date	June 19, 1972			
Steam Capacity lbs/hr	10,350 lbs/hr			
Operating Pressure-psi	Maximum - 130 psig Minimum - 118 psig			
Steam Temp. °F T T	338° F			
Feed Water Temp.	205° F			
Economizer Exit Gas Temp.	None			
Air Heater Exit Gas Temp.	450° F Stack Temp.			
Design Efficiency %	80%			
Present Fuel Used	Gas and Oil			
Stoker Type and Manufacturer	None			
Stoker Dimensions	None			
No. of Coal Pulverizers	None			
Manufacturer and Type of Pulverizer	None			
Mechanical Dust Collector	None			
Electrostatic Precipitator	None			
Average Summer Steam Load	2,798,000 #/Five Months or 127,181 #/Week Average			
Average Winter Steam Load	12,461,000 #/Seven Months or 415,366 #/Week Average			
Type of Ash Handling Equipment	None			

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RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility WITCO CHEM. CORP.
Location BRADFORD, PA.
Telephone No. 814 368-6111
Plant Manager G. L. GIFFORD
Chief Engineer P. W. TIMBROOK (contact for information)

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer		CE	ERIE CITY	ERIE CITY
Type or Class		WT	WT	WT
Start-up Date		1937	1970	1970
Steam Capacity lbs/hr		50 M	80 M	80 M
Operating Pressure-psi		150	600	600
Steam Temp. °F T T		515°	770°	770°
Feed Water Temp.		214°	240°	240°
Economizer Exit Gas Temp.				
Air Heater Exit Gas Temp.		495°		
Design Efficiency %				
Present Fuel Used		COAL/OIL	OIL	OIL
Stoker Type and Manufacturer				
Stoker Dimensions				
No. of Coal Pulverizers		1		
Manufacturer and Type of Pulverizer		CE		
Mechanical Dust Collector		Yes		
Electrostatic Precipitator		NO		
Average Summer Steam Load		40	50	50
Average Winter Steam Load		50	60	60
Type of Ash Handling Equipment				

APRIL 15, 1975

SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility Allegheny Ludlum Steel Corporation
Location Dunkirk, New York 14048
Telephone No. 366-1000(AC 716)
Plant Manager A. J. Lene
Chief Engineer J. E. Trabits, P.E.

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	Babcock & Wilcox Co.	Babcock & Wilcox Co.		
Type or Class	Water Tube	Water Tube		
Start-up Date	1939	1942		
Steam Capacity lbs/hr	50,000	50,000		
Operating Pressure-psi	150	150		
Steam Temp. °F % T	416°	416°		
Feed Water Temp.	205° F	205° F		
Economizer Exit Gas Temp.	No Economizer	No Economizer		
Air Heater Exit Gas Temp.	No Air Heater	300° F		
Design Efficiency %	85.7	85.7		
Present Fuel Used	Natural Gas	Oil		
Stoker Type and Manufacturer	None	None		
Stoker Dimensions	None	None		
No. of Coal Pulverizers	None	1		
Manufacturer and Type of Pulverizer	None	Babcock & Wilcox Co. Size 126 Class 221-B		
Mechanical Dust Collector	None	None		
Electrostatic Precipitator	None	None		
Average Summer Steam Load	19000#/hr.	Only one boiler operates at any one time		
Average Winter Steam Load	45000#/hr.			
Type of Ash Handling Equipment	None	None		

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JUNE 13, 1975

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RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
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Owner of Facility DRESSER CLARK
Location OLEAN New YORK 14760
Telephone No. 372-2101
Plant Manager PIET MAARSEN
Chief Engineer BOB POTTER

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	BABCOCK & WILCOX	"	"	"
Type or Class	FM STANDARD	"	"	"
Start-up Date	JULY-72	JULY-72	APR-74	APR 74
Steam Capacity lbs/hr	60,000	60,000	140,000	52,000
Operating Pressure-psi	700 PSI	700 PSI	700 PSI	250PSI
Steam Temp. °F T T	700°F	800°F	700°F	—
Feed Water Temp.	240°F	240°F	240°F	240°F
Economizer Exit Gas Temp.	650°F	650°F	650°F	500°F

Air Heater Exit Gas Temp. ______

Design Efficiency %

Present Fuel Used #2 FUEL OIL & NATURAL GAS ALL BOILERS

Stoker Type and Manufacturer ______

Stoker Dimensions ______

No. of Coal Pulverizers ______

Manufacturer and Type of Pulverizer ______

Mechanical Dust Collector ______

Electrostatic Precipitator ______

Average Summer Steam Load ______

Average Winter Steam Load ______

Type of Ash Handling Equipment ______

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RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility Asphalt Service Inc.
Location Sixton St Jamestown N.Y.
Telephone No. 664 3750
Plant Manager Jim Clark
Chief Engineer

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	Titusville Atlas			
Type or Class	Gas fired			
Start-up Date	(depending on weather) last of April to the first of May			
Steam Capacity lbs/hr	150 lbs.			
Operating Pressure-psi	60 - 75 lbs			
Steam Temp. °F T T	307 - 320 °F			
Feed Water Temp.	170 - 180 °F			
Economizer Exit Gas Temp.				
Air Heater Exit Gas Temp.				
Design Efficiency %				
Present Fuel Used	Gas Max 3.4 capacity			
Stoker Type and Manufacturer				
Stoker Dimensions				
No. of Coal Pulverizers				
Manufacturer and Type of Pulverizer				
Mechanical Dust Collector				
Electrostatic Precipitator				
Average Summer Steam Load	60 lbs.			
Average Winter Steam Load	Summer operation only			
Type of Ash Handling Equipment				

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RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
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Owner of Facility KRAFT FOODS
Location 26-38 E. TALCOTT - DUNKIRK, N.Y.
Telephone No. 366-2000
Plant Manager W. J. STASIEWICZ
Chief Engineer N. J. PLESZEWSKI

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	ERIE CITY	T. TUSVILLE	WICKES	
Type or Class	WATERTUBE	WATERTUBE	WATERTUBE	
Start-up Date				
Steam Capacity lbs/hr	30,000/hr	15,000/hr	15,000/hr	
Operating Pressure-psi	125	125	125	
Steam Temp. °F T T				
Feed Water Temp.				
Economizer Exit Gas Temp.				
Air Heater Exit Gas Temp.				
Design Efficiency %				
Present Fuel Used	gas	gas	gas	
Stoker Type and Manufacturer				
Stoker Dimensions				
No. of Coal Pulverizers				
Manufacturer and Type of Pulverizer				
Mechanical Dust Collector				
Electrostatic Precipitator				
Average Summer Steam Load	22,000/hr			
Average Winter Steam Load	26,000/hr			
Type of Ash				

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RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility CARNATION COMPANY
Location 1st St. South Dayton, N.Y. County of Cattaraugus
Telephone No. 716-988-3224
Plant Manager Gary Jordan
Chief Engineer W. R. Mirwald

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	Cleaver Brooks	Cleaver Brooks		
Type or Class	Water tube-Mod. D-52	Ditto		
Start-up Date	Dec. 1970	"		
Steam Capacity lbs/hr	30,000 #/Hr.			
Operating Pressure-psi	150 PSI			
Steam Temp. °F T T	365 deg. F. Gauge pressure			
Feed Water Temp.	210 deg. F.			
Economizer Exit Gas Temp.	Stack Temp. 560 Deg. F.			
Air Heater Exit Gas Temp.	---			
Design Efficiency %	85			
Present Fuel Used	#6 Fuel Oil			
Stoker Type and Manufacturer	None			
Stoker Dimensions	None			
No. of Coal Pulverizers	None			
Manufacturer and Type of Pulverizer	None			
Mechanical Dust Collector	None			
Electrostatic Precipitator	None			
Average Summer Steam Load	23,000 #/hr 12 hrs per day.			
Average Winter Steam Load	23,000 #/hr 9 hrs per day			
Type of Ash Handling Equipment	None			

APRIL 15, 1975

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RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

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Owner of Facility KLING DIVISION OF [illegible]
Location MAYVILLE Mayville, New York 14757
Telephone No. 753-2121
Plant Manager HENRY WALKER
Chief Engineer DICK SMITH

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	KEELER	BABCOCK+ WILCOX	TITUSVILLE	
Type or Class	W.T.	W.T.	W.T.	
Start-up Date	1940	1969	1955	
Steam Capacity lbs/hr	10,000	20,000	15,000	
Operating Pressure-psi	60	100	75	
Steam Temp. °F T T	310	340	320	
Feed Water Temp.	212	212	212	
~~Economizer~~ STACK Exit Gas Temp.	450	500	450	
Air Heater Exit Gas Temp.				
Design Efficiency %	75	80	80	
Present Fuel Used	WOOD WASTE	#6 OIL	WOODWASTE AND #6 OIL	
Stoker Type and Manufacturer	SPECIAL BLOWER		SPECIAL BLOWER	
Stoker Dimensions				
No. of Coal Pulverizers	NONE	NONE	NONE	
Manufacturer and Type of Pulverizer				
Mechanical Dust Collector	NONE	NONE	NONE	
Electrostatic Precipitator	NONE	NONE	NONE	
Average Summer Steam Load	9000	-0-	8000	
Average Winter Steam Load	10,000	20,000	15,000	
Type of Ash Handling Equipment	NONE	NONE	NONE	

APRIL 15, 1975

SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility Fred Koch Brewery
Location 15-25 West Courtney Street , Dunkirk, New York 14048
Telephone No. 716-366-3333
Plant Manager John D. Koch
Chief Engineer Kenneth Thies

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Mayville, New York 14757

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	North American	Cleaver Brooks		
Type or Class	Fire Tube Scotch Marine Boiler	Fire Tube Scotch Marine Boiler		
Start-up Date	2-17-71	Jan. 1970		
Steam Capacity lbs/hr	8000	8000		
Operating Pressure-psi	130 lb.	130 lb.		
Steam Temp. °F T T	356 °	356 °		
Feed Water Temp.				
Economizer Exit Gas Temp.				
Air Heater Exit Gas Temp.				
Design Efficiency %				
Present Fuel Used	Gas	Gas (oil can be used)		
Stoker Type and Manufacturer				
Stoker Dimensions				
No. of Coal Pulverizers				
Manufacturer and Type of Pulverizer				
Mechanical Dust Collector				
Electrostatic Precipitator				
Average Summer Steam Load				
Average Winter Steam Load				
Type of Ash Handling Equipment				

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SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility MARLIN ROCKWELL DIV. TRW INC.
Location JAMESTOWN, NEW YORK 402 CHANDLER ST
Telephone No. 661-2600
Plant Manager EUGENE BUCCOLA
Chief Engineer HAROLD L. SWANSON

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	SUPERIOR	SUPERIOR	Union ✓	
Type or Class	SCOTCH MARINE	SCOTCH MARINE	watertube type A	
Start-up Date	1970	1970	1955	
Steam Capacity lbs/hr	8000	8000	20,000	
Operating Pressure-psi	100#/sq in	100#/sq in.	100#/sq in	
Steam Temp. °F T T	340°	340°	340°	
Feed Water Temp.	140°	140°	140°	
Economizer Exit Gas Temp.	None	None	None	
Air Heater Exit Gas Temp.	None	None	None	
Design Efficiency %	?	?	?	
Present Fuel Used	Gas	Gas	Coal	
Stoker Type and Manufacturer	None	None	Type E Combustion Engineering underfeed	
Stoker Dimensions	None	None	?	
No. of Coal Pulverizers	None	None	None	
Manufacturer and Type of Pulverizer	None	None	None	
Mechanical Dust Collector	None	None	None	
Electrostatic Precipitator	None	None	None	
Average Summer Steam Load	5000	No load	3000	
Average Winter Steam Load	7000	7000	11000	
Type of Ash Handling Equipment	None	None	None	

Boiler #3 laid up for emergency back up use only. Poor condition.

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SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility: Renold Ajax Inc.
Location: Corner English & Portage Streets, Westfield, New York
Telephone No.: 326-3121
[illegible]: Garth Thompson, Manager of Manufacturing
Chief Engineer:

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	Weil-Mc Lain			
Type or Class	ASME Standard			
Start-up Date	September each year			
Steam Capacity lbs/hr	15 lbs.			
Operating Pressure-psi	5 lbs.			
Steam Temp. °F T T	226°			
Feed Water Temp.	50°			
Economizer Exit Gas Temp.	N/A			
Air Heater Exit Gas Temp.	N/A			
Design Efficiency %	N/A			
Present Fuel Used	Natural gas (converted from coal to oil to gas)			
Stoker Type and Manufacturer	N/A			
Stoker Dimensions	N/A			
No. of Coal Pulverizers	N/A			
Manufacturer and Type of Pulverizer	N/A			
Mechanical Dust Collector	N/A			
Electrostatic Precipitator	N/A			
Average Summer Steam Load	N/A			
Average Winter Steam Load	N/A			
Type of Ash Handling Equipment	N/A			

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SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility Roblin Steel Company, A Division of Roblin Industries, Inc.
Location 320 South Roberts Road, Dunkirk, NY 14048
Telephone No. (716) 366-7700
Plant Manager Gene Kimmel
Chief Engineer Charles W. Simmons, 101 East Avenue, North Tonawanda, NY 14120

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	Kewanee Boiler Corp.	Same as #1	Same as #1	
Type or Class	Package	"	"	
Start-up Date	January, 1976	"	"	
Steam Capacity lbs/hr	6900	"	"	
Operating Pressure-psi	150	"	"	
Steam Temp. °F T T	366°	"	"	
Feed Water Temp.	60°F	"	"	
Economizer Exit Gas Temp.	N.A.*	"	"	
Air Heater Exit Gas Temp.	N.A.	"	"	
Design Efficiency %	83 (gas)	"	"	
Present Fuel Used	Fuel gas (#2 oil is an alternate)	"	"	
Stoker Type and Manufacturer	N.A.	"	"	
Stoker Dimensions	N.A.	"	"	
No. of Coal Pulverizers	N.A.	"	"	
Manufacturer and Type of Pulverizer	N.A.	"	"	
Mechanical Dust Collector	None	"	"	
Electrostatic Precipitator	None	"	"	
Average Summer Steam Load	5000 lb/hr (average load for total system)			
Average Winter Steam Load	5000 lb/hr	"	"	
Type of Ash Handling Equipment	N.A.	"	"	

*Not applicable

APRIL 15, 1975

SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility True Temper Corp.
Location E. Lake Rd. Dunkirk, N.Y. 14048
Telephone No. 366-3550
Plant Manager N.J. Shopland
Chief Engineer A.S. Brinkerhoff

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer				
Type or Class				
Start-up Date	None			
Steam Capacity lbs/hr				
Operating Pressure-psi				
Steam Temp. °F T T				
Feed Water Temp.				
Economizer Exit Gas Temp.				
Air Heater Exit Gas Temp.				
Design Efficiency %				
Present Fuel Used				
Stoker Type and Manufacturer				
Stoker Dimensions				
No. of Coal Pulverizers				
Manufacturer and Type of Pulverizer				
Mechanical Dust Collector				
Electrostatic Precipitator				
Average Summer Steam Load				
Average Winter Steam Load				
Type of Ash Handling Equipment				

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Boiler No. Yr. Installed	Rated Capacity (max. cont.)	Firing Method If Stoker, Type	Avg. Use Day/Yr.	Dust Collector		
				Type	Mfgr.	Des. Eff.
1950	17,000 #/HR	SRUF	20			

Stack Height(s) 62 ft Annual Tonnage 400 Company Name Welch Foods Inc
Westfield

LEGEND

PC - Pulverized Coal
SSS - Stationary Grate Spreader
DSS - Dump Grate Spreader
CAD - Continous Discharge Spreader

SRUF - Single Retort Underfeed
MRUF - Multiple Retort Underfeed
VG - Vibra Grate
CG - Chain or Travelling Grate

CT - Cinder Trap
LLC - Low Draft Loss Cyclone
HLC - High Draft Loss Cyclone
EP - Electrostatic Precipitator

Please Return By February 14, 1969

Boiler No. Yr. Installed	Rated Capacity (max. cont.)	Firing Method If Stoker, Type	Avg. Use Day/Yr.	Dust Collector		
				Type	Mfgr.	Des. Eff.
#9	150,000#/hr.	P.C.	270	Mech. & EP	Western Precip.	95%
#10	150,000#/hr.	P.C.	270	Mech. & EP	Western Precip.	95%
#11	150,000#/hr.	P.C.	270	Mech. & EP	Aerotec.	96%
#12	230,000#/hr.	P.C.	270	Mech. & EP	Research Cottrell	98%

Stack Height(s) 200' Annual Tonnage 128,578 Company Name Board of Public Utilities, City of Jamestown, N. Y.

LEGEND

PC - Pulverized Coal
SSS - Stationary Grate Spreader
DSS - Dump Grate Spreader
CAD - Continous Discharge Spreader

SRUF - Single Retort Underfeed
MRUF - Multiple Retort Underfeed
VG - Vibra Grate
CG - Chain or Travelling Grate

CT - Cinder Trap
LLC - Low Draft Loss Cyclone
HLC - High Draft Loss Cyclone
EP - Electrostatic Precipitator

Please Return By February 14, 1969

#9 & #10 BOILERS (COMBUSTION ENGINEERING) INSTALLATION - 1950

Type VU Steam Generator Pulverized coal Balanced Draft

Heating Surface Boilers - 9465 Sq. Ft.
Water Walls - 6750 Sq. Ft.

Pressure - 1020 psi

Temperature (S.H. Steam) - 900° F

Capacity - 150,000 lbs. steam/hr.

Coal Fired - 15,500 lbs/hr.

Boiler Input - 201 million BTU/hr.

Ignition and Warmup - #2 fuel oil

Gas Flow - 76,288 ACFM

Gas at Airheater Outlet - 222,000 lbs/hr. (Includes 10% leakage)

Buell Envirotech Precipitator

#11 BOILER ERIE CITY IRON WORKS INSTALLATION - 1958

Type IWT (Pulverized Coal) Balanced Draft

Heating Surface Boiler - 10405 Sq. Ft.
Water Walls - 5820 Sq. Ft.

Pressure - 1000 psi

Temperature (S.H. Steam) - 900°F

Capacity - 165,000 lbs steam/hr.

Coal Fired - 16,500 lbs/hr.

Boiler Input - 214 million BTU/hr.

Ignition and Warmup - #2 fuel oil.

Gas Flow - 81,099 ACFM

Gas at Airheater outlet - 236,000 lbs/hr. (Includes 10% air leakage)

Buel Envirotech Precipitator

#12 BOILER ERIE CITY IRON WORKS INSTALLATION - 1968

Type 2 Drum (Pulverized Coal) Balanced Draft

Heating Surface Boiler - 11,744
Water Walls - 4,372

Pressure - 1050 psi

Temperature (S.H. Steam) - 900°F.

Capacity - 230,000 lbs. steam/hr.

Coal Fired - 23,000 lbs/hr.

Boiler Input - 299 million BTU/hr.

Ignition and Warmup - #2 Fuel Oil

Gas Flow - 113,058 ACFM

Gas at Airheater Outlet - 329,000 lbs/hr. (Includes 10% air leakage)

Buell Envirotech Precipitator

Point Drive North

APRIL 15, 1975

SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility NIAGARA MOHAWK POWER CORP.
Location DUNKIRK, NEW YORK
Telephone No. 366-4444
Plant Manager Leo O'Sullivan
Chief Engineer ______

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	C/E	C/E	C/E	C/E
Type or Class	Natural Circulation	Natural Circulation	Controlled Circulation Twin Furnace	Controlled Circulation Twin Furnace
Start-up Date	Oct. 1950	Dec. 1950	Aug. 1959	June 1960
Steam Capacity lbs/hr	670,000	670,000	1,470,000	1,470,000
Operating Pressure-psi	1450	1450	2400	2400
Steam Temp. °F T T	SH RH 1000/1000	SH RH 1000/1000	SH RH 1050/1000	SH RH 1050/1000
Feed Water Temp. To Econ.	456F	456F	520F	520F
Feed Water Temp. To Boiler	503F	503F	543F	543F
Economizer Exit Gas Temp.	565F	565F	570F	570F
Air Heater Exit Gas Temp.	275F	275F	300F	300F
Design Efficiency %	89.3	89.3	89.75	89.75
Present Fuel Used	Coal	Coal	Coal	Coal
Stoker Type and Manufacturer	----	----	----	----
Stoker Dimensions	----	----	----	----
No. of Coal Pulverizers	4	4	6	6
Manufacturer and Type of Pulverizer	CE Raymond Bowl #533A	CE Raymond Bowl #533A	CE Raymond Bowl #633	CE Raymond Bowl #633
Mechanical Dust Collector	---	---	---	---
Electrostatic Precipitator	Yes	Yes	Yes	Yes
Average Summer Steam Load	525,000#/hr.	525,000#/hr.	1,010,000#/hr.	1,010,000#/hr.
Average Winter Steam Load	525,000#/hr.	525,000#/hr.	1,010,000#/hr.	1,010,000#/hr.
Type of Ash Handling Equipment	Dry Pressurized Air	Dry Pressurized Air	Dry Pressurized Air	Dry Pressurized Air

RECEIVED JUN 23 1975 DUNKIRK STEAM STATION

CUMMINS ENGINE COMPANY, INC.
JAMESTOWN COMPONENTS PLANT
LAKEWOOD, NEW YORK 14750

CUMMINS

TELEPHONE AREA CODE 716
456-2111

October 2, 1975

Mr. John Splendore
GILBERT ASSOCIATES, INC.
800 Hill Avenue
Wyomissing, Pennsylvania

Dear Mr. Splendore:

I am enclosing the Information Sheet which you requested during our initial meeting. As discussed with Mr. Stone on September 29, 1975, we are still interested in your proposal. The 47,000 #/hr capability would be easier for us to accommodate during summer conditions than the 70,000# minimum discussed earlier.

Some parameters have changed since our original meeting relative to our total energy plan. Options have developed and we are currently not able to commit to coal boiler, conversion of our HV units to steam, or plant air conditioning. Therefore, our master plan boiler room is still in limbo. We are trying to keep all of our options open and would like to reiterate that the processed refuse supplied to Cummins by the County will remain a viable alternative as long as the economics make sense.

Thank you for informing us of your plans. Please keep us informed of developments or of other information which you may require from us.

Sincerely,

S. M. Forster

S. M. Forster
Facilities Project Manager

S.M. Forster/omu

RECEIVED
OCT 3 1975
DIV.
RDG.

SOLID WASTE MANAGEMENT
RESOURCE RECOVERY ANALYSIS
BOILER PLANT SURVEY
CHAUTAUQUA COUNTY, NEW YORK
PREPARED BY
GILBERT ASSOCIATES, INC.

Owner of Facility Cummins Engine Company
Location 4720 Baker Street
Telephone No. 716/456-2111
Plant Manager Richard Allison
Chief Engineer Curt Stone

	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4
Boiler Manufacturer	Cleaner Brooks	To Be Determined	To Be Determined	To Be Determined
Type or Class	CB-Package Boiler			
Start-up Date	March 31, 1976			
Steam Capacity lbs/hr	20,085 #/hr			
Operating Pressure-psi	150 psig Boiler 60/120 psig Dist.			
Steam Temp. °F T T	60 psig - 290° 120 psig - 340°			
Feed Water Temp.	180° - 230°			
Economizer Exit Gas Temp.	N/A			
Air Heater Exit Gas Temp.	N/A			
Design Efficiency %	80%			
Present Fuel Used	Gas/#2/#6			
Stoker Type and Manufacturer	N/A			
Stoker Dimensions	N/A			
No. of Coal Pulverizers	N/A			
Manufacturer and Type of Pulverizer	N/A			
Mechanical Dust Collector	N/A			
Electrostatic Precipitator	N/A			
Average Summer Steam Load	26,000 #/hr (1980)			
Average Winter Steam Load	75-80,000 #/hr (1980) If we convert air handling units to steam			
Type of Ash Handling Equipment	N/A			

Reproduced from best available copy.

JAMESTOWN BOARD OF PUBLIC UTILITIES CARLSON STATION
OPERATING CONDITIONS - 1975
CHAUTAUQUA COUNTY, NEW YORK

* Source: 1975 Jamestown BPU Annual Report - page 10

COST SUMMARY

1. Cost to Generate:

$$\frac{\$4{,}240{,}580^*}{210{,}535{,}800^*\text{ KWH generated in 1975}}$$

$$= \underline{\$0.02/\text{KWH cost to generate}}$$

2. Cost to Purchase:

$$\frac{\$\ 782{,}567^*}{116{,}326{,}000^*\text{ KWH purchased in 1975}} = \$0.0067\text{ KWH}$$

$$= \underline{\$0.007/\text{KWH cost to purchase}}$$

3. Ratio

$$\frac{\$0.02}{\$0.007} = \underline{2.8}$$

2.8 times more to generate than purchase power

4. Fuel Cost per KWH Generated

$$\frac{\$\ 3{,}142{,}028^*\text{ coal cost 1975}}{210{,}535{,}800^*\text{ KWH generated 1975}} = \$0.015\text{ coal cost/KWH generated}$$

$$\frac{\$0.015\text{ coal cost}}{\$0.02\text{ generator cost}} = .75 \times 100 = \underline{75\%}$$ Cost of Fuel for entire Generating costs 1975

$$\frac{\$\ 142{,}028}{4{,}240{,}580} = 75\%$$

5. Cost to Purchase All Power in 1975 (If it were possible to do so - currently it is not)

- Purchase price $0.007/KWH
- Total KWH used in 1975: generated & purchased (less Station KWH uses)

	326,861,000* KWH
	- 17,024,900* KWH
	309,836,100 KWH Total

($0.007/KWH) (309,836,100 KWH) = $2,169,000 Total Cost to purchase all Power 1975

6. Savings by Purchasing all Power in 1975 (If possible)

Gross Cost of Generation & Purchase	$5,023,686*
Gross Cost of All Purchased Power	2,169,000
Net Potential Savings	$2,854,686

7. Net Potential Savings Versus Coal Cost

$$\frac{\$2,854,686 \text{ Savings}}{\$3,142,028^{*} \text{ Coal Cost}} = 91\% \text{ of Coal Costs in 1975}$$

8. Refuse Derived Solid Fuel

RDF: @ 385 TPD refuse = 287 TPD; refined fuel fraction (RFF)

@ 10.88 MBTU/ton of RFF when compared to coal

Coal: 12,500 BTU/lb = 25 MBTU/ton

$$\frac{25 \text{ MBTU/ton coal}}{10.88 \text{ MBTU/ton RFF}} = 2.3 \text{ times more RFF need to equivalent coal}$$

@ 287 TPD RFF

$$\frac{287 \text{ TPD}}{2.3} = 125 \text{ tons of coal displaced by RDF daily}$$

Therefore, RDF is produced 282 Days per year

(282) (125 tons) = 35,250 tons per year coal displaced

@ $28.28*/ton for 1975 coal

= $99,690 Annual Cost Saving by using RDF and not paying revenue for its use

9. Assume No Charge for RDF

a. $$\frac{\$\ 996,900}{\$3,142,028^{*} \text{ coal cost}} = 32\% \text{ Reduction in Coal Cost}$$

b. $$\frac{\$\ 996,900}{\$5,023,686^{*} \text{ coal cost}} = 20\% \text{ Reduction in Total Gross Purchase and Generating Costs}$$

Assuming all RDF could be taken at BPU Facility.

10. Summary

a.	Cost of Operation - 1975	\$5,023,686
b.	Cost to Purchase all Power if possible	\$2,169,000
c.	Value of RDF Displacing Coal at no cost to BPU	\$ 996,900

d. Cost savings of purchasing all power, if possible versus existing total cost:

$$\frac{(\$5{,}023{,}686) - (\$2{,}169{,}000)}{(\$5{,}023{,}686)} \times 100 = 56\%$$ Cost savings to purchase all power

e. Cost savings existing total cost versus use of solid RDF at no charge:

$$\frac{\$\ 996{,}900}{\$5{,}023{,}686} \times 100 = 20\%$$ Reduction in total existing cost using free RDF

f. Cost savings of existing costs less RDF credits versus purchase all power if possible:

$$\$5{,}023{,}686 - \$996{,}000 = \$4{,}027{,}686$$

$$\frac{(\$4{,}027{,}686) - (\$2{,}169{,}000)}{(\$4{,}027{,}686)} \times 100 = 46\%$$ Cost savings to purchase all power even using free RDF

g. Cost savings of existing total costs versus use of solid RDF with BPU pay 75% of current coal costs for the solid-RDF:

- Annual value of solid-RDF at current coal cost

  \$996,900

- Charge for Solid RDF - 75% of current coal costs

  (\$996,900) (75%) = \$747,675 RDF Charge

- Savings to BPU for using RDF

  \$996,900 - 747,675 = \$249,225 BPU Savings using RDF

- Cost savings of Total Costs versus use of solid-RDF at 75% charge of existing coal costs

$$\frac{\$\ 249{,}225}{\$5{,}023{,}606} = 5\%$$ Reduction in total existing costs using RDF RDF @ 75% of coal cost

Gilbert/Commonwealth engineers and consultants

GILBERT ASSOCIATES, INC., P. O. Box 1498, Reading, PA 19603/Tel. 215 775-2600/Cable Gilasoc/Telex 836-431

February 20, 1976

Mr. Robert Seibel
Erie City Energy Division of Zurn Industries
1422 East Avenue
Erie, PA 16503

Re: Questions concerning use of solid refuse derived fuel supplement at Jamestown, N.Y. Board of Public Utilities Plant; Units #11 and 12
W.O. 06-7126-000

Dear Mr. Seibel:

We are conducting a study in Chautauqua County to determine the feasibility of resource recovery from municipal and certain industrial solid wastes. In the study we are addressing the preparation of the wast materials into a combustible solid refuse derived fuel (RDF), shredded to a 1/4 to 2 inch piece size range. The RDF will principally consist of paper and corrugated paper material (approximately 50-70%) with about 3-5% plastics, 15-20% food wastes, 10-15% wood, textiles, rubber, leather, and yard wastes and 1-4 non combustibles. The approximate heating value of the RDF is about 5190 BTU/lb. RDF will produce approximately 20-25% ash upon combustion, with ash fusion temperatures ranging between 2000 - 2300° F.

The following questions were raised in a meeting with the Jamestown BPU officials. It was their desire that the questions be sent to your firm for a response, since the Erie City Units #11 and 12 are the candidates for conversion to accept RDF.

1. Adequacy of furnace height (flame travel) and therefore retention time for complete combustion of RDF in the furnace.
2. Provisions required to consume dense plastics, rubber, wood knots, etc. which may be introduced with RDF.
3. Adequacy of/or modifications required to present ash handling facilities.
4. Furnace fouling characteristics, of the coal, RDF and composite fuel ash fusion temperatures.
5. Corrosion effect on the furnace and water wall tubing with respect to various RDF firing rates in combination with coal at the following RDF to coal percentages: (a) 10%:90% (b) 20%:80% (c) 30%:70% (d) 40%:60% (e) 50%:50%
6. Effect of RDF firing on Ljungstrom air heater.

7. What effect does burning solid RDF have on superheat temperature?

8. How will the steam soot blower operation possibly be affected?

9. What, if any, furnace tube wall modifications will be required?

10. Will RDF flyash particle size affect the electrostatic precipitators?

We are attempting to complete the report in early March, therfore your earliest reply will be appreciated. Should you desire any additional information, please contact me.

Very truly yours,

RICHARD E. VALIGA, P.E.
Project Engineer
Environmental Division

REV:jm

cc: J. Pullan
M. Panzarella
J. Luensman
P. Nevius

Gilbert/Commonwealth engineers and consultants

GILBERT ASSOCIATES, INC., P. O. Box 1498, Reading, PA 19603/Tel. 215 775-2600/Cable Gilasoc/Telex 836-431

February 24, 1976

Mr. Robert Seibel
Erie City Energy Division of Zurn Industries
1422 East Avenue
Erie, PA 16503

Re: Phone Conversation 2/24/76
Chautauqua County
06-7126-000

Dear Mr. Seibel:

To confirm our phone conversation of Tuesday, the heating and ash value of the refuse derived fuel (RDF) given in the February 20th letter was incorrect. Those values were for the unprocessed waste materials. The processed RDF has an approximate heating value of 6630 Btu/lb. with 16% moisture and 15% ash upon combustion.

As you indicated we could expect your reply in approximately one week.

If you need additional information, please contact me.

Very truly yours,

RICHARD E. VALIGA, P.E.
Project Engineer
Environmental Division

REV:jm

cc: J. Luensman
J. Gerace
M. Panzarella
J. Pullan
P. Nevius

525 Lancaster Avenue, Reading, PA 800 Hill Avenue, Wyomissing, PA / Morgantown Road, Green Hills, Reading, PA 215 775-2600
209 East Washington Avenue, Jackson, MI 517 788-3000 / 80 Pine Street, New York, NY 212 422-3177

ZURN a step ahead of tomorrow

June 8, 1976

Gilbert Associates, Inc.
P.O. Box 1498
Reading, Pa. 19603

Attention: Mr. R. E. Valiga
Project Engineer

Subject: Use of Refuse Derived Fuel
E.C.E.D. Orders 43/58
10465

Dear Mr. Valiga:

This is in response to the questions you posed concerning the use of Refuse Derived Fuel in the two Erie City steam generators at the Jamestown plant. Unfortunately, we find that we cannot respond authoritatively since we do not have the experience of designing or firing refuse fuel with one of our units.

Erie City has marketed refuse incineration systems considering only bulk burning technique and equipment. We have designed and offered several units and, presently, we have a steam generator of our unique design in service at the City of Hempstead, Long Island, New York.

In the case of units similiar to the Jamestown units (which are designed for suspension-firing pulverized-coal), Erie City has no design or operating experience in converting a similiar unit for refuse fuel burning. There is, however, other experience available to draw from.

Our judgement about the use of refuse fuel is that it is a matter of proportion of refuse flow to coal flow. If the proportion of refuse fuel to total fuel requirements is low - perhaps 10 to 20% - conversion to partial refuse fuel input would be feasible without major alterations. Questions relating to flame travel, ash handling, fouling characteristics, air heater pluggage and, so on, are best answered by relating the Jamestown unit design to other experience. For example, in comparing the Union Electric experience to the Jamestown units, steaming capacity is much less, but furnace configuration along with the arrangement of boiler convection surface, combustion air heater and electrostatic precipitator appears to be very similar. Direct comparisons would be valid.

ZURN INDUSTRIES, INC. ERIE CITY ENERGY DIV. 1422 EAST AVE., ERIE, PA, U.S.A. 16503 PHONE: 814/452-6421

On the other hand, if the proportion of refuse fuel to total heat input is greater than 20% our judgement, based only on literature reports of other experience, is that major alterations to the units are required. A new fuel burning system along with different ash handling equipment and gas cleanup appears to be required.

In our opinion, the first step in analyzing economic factors involving boiler capabilities is to establish the amount of refuse fuel available.

Very truly yours,

ERIE CITY ENERGY DIV.
ZURN INDUSTRIES, INC.

RV Seibel
Robert V. Seibel
Manager - Design Engineering

RVS/nlz

cc: C. L. Hedrick
Vice President-
General Manager

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JUN 11 1976
GAI
ENV. DIV.
RDG.

SOLID AND GASEOUS REFUSE DERIVED FUEL EFFECTS ON BOILERS

Source: "Fuels from Municipal Refuse for Utilities: Technology Assessment" by the Electrical Power Research Institute, March, 1975

SOLID REFUSE DERIVED FUEL

Union Electric Demonstration Program

The process of recovering energy by burning shredded municipal waste as a supplementary fuel in power plant boilers was studied initially in 1968 by the City of St. Louis and the Union Electric Company. The results of the study were encouraging. In 1970, a demonstration was initiated when the U.S. Environmental Protection Agency's Office of Solid Waste Management Programs and Office of Air Programs jointly awarded a grant to the City of St. Louis for two-thirds of the cost of the project.

Operation began in April 1972 and continued intermittently until stopped in May 1973 for minor modifications, including the installation of an air-classifier. Operation resumed in November 1973 and has continued to date. These facilities are typical of those required by any plant with suspension-fired boilers. The surge bin uses four drag-chain unloading conveyors to move the solid waste fuel to four separate feeders that introduce the supplementary fuel into the pneumatic pipeline system. The fuel transport lines, each about 700 feet long, blow the fuel to firing ports in the corner of the boiler furnace.

Prior to the addition of the air classification, larger and heavier particles caused feeder blockages, and the glass caused serious wear to the pipelines, especially at the elbows. These conditions required excessive maintenance and an operator to monitor the system. With the installation of the air-classifier, the system can be operated with minimum supervision and routine maintenance.

Boiler Modifications. Two identical boilers (Unit Nos. 1 and 2) at Union Electric Company's Meramec Plant near St. Louis have been modified to burn prepared solid waste. They are 125 Mw tangentially suspension-fired boilers originally designed to burn pulverized coal or gas. There are now four coal-firing, one solid-waste-firing, and five gas-firing ports in each corner of each boiler.

Other than installing a solid waste burning port in each corner of the furnace, no modifications to the boilers were made. No alterations to the pressure parts of the boilers were necessary. (Pressure parts are the water/steam circuits that line and form the inside boiler walls.) The prepared solid waste is burned in suspension, in the same flame pattern as the pulverized coal or gas.

The two boilers are 20 years old and are small compared with newer units in the Union Electric Company system. They are of modern reheat design, however, and burn 56.5 tons of Illinois coal per hour at rated load.

At rated load, the quantity of solid waste for each boiler, equivalent in heating value to 10 percent of the coal, is about 12.5 tons per hour or 300 tons per 24-hour day. Solid waste will be fired 24 hours per day, but only 5 days per week, since city residential solid waste collections are scheduled on a 5-day-per-week basis.

General Operations. The boiler operators and shift superintendents report that solid waste firing has had no discernible effect on the boiler furnace or convection passes. Frequent or sudden interruptions of the solid waste feed have not required any change in operating techniques. Existing boiler combustion controls easily accommodate the variations in solid waste quantity and quality by varying the amount of pulverized coal fired in the boiler.

Corrosion. Utility steam generator supplemental firing with prepared MSW is an innovation in the United States. Experience at Union Electric's Meramec plant has so far indicated that corrosion is not a major problem in supplemental firing. The results of corrosion tests will be available shortly from Union Electric. Surprisingly, visual inspection of the internal surfaces at Meramec shows the internal surfaces generally cleaner and more free of ash deposits than before supplemental firing. (One theory is that the high clay content of slick-surface magazine paper may be supplying beneficial metallic oxides that reduce ash deposit corrosion.)

Any utility proceeding with a supplemental firing program should include temperature-controlled probes to measure and evaluate tube wastage. The three major areas within the furnace and steam generator that should be fitted with probes are:

Burner zone - for water-wall tube wastage

Upper furnace - for superheater and reheater tube wastage

Outlet duct of the air heater - for low-temperature corrosion

In coal-fired boilers, high-temperature of liquid-phase coal-ash corrosion can be minimized by limiting the peak metal temperatures of the finishing sections of heating surface to about 1100°F, as illustrated in Figure 1. It remains to be seen whether this temperature limit and curve are equally applicable to prepared MSW.

Short-term corrosion test results are sometimes misleading since initial corrosion rates can be much higher than long-term corrosion rates after stabilization has taken place. Any test program should be long enough to allow an assessment of long-term corrosion rate.

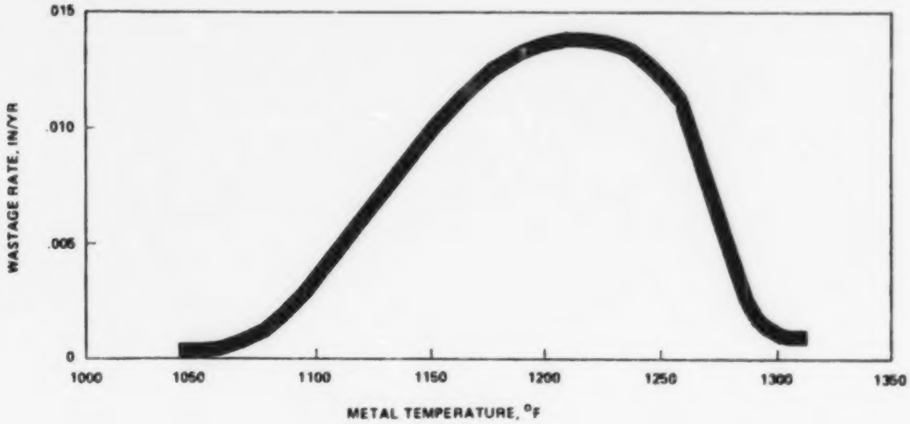

Figure 1. Rate of Wastage from Liquid Phase, Coal-Ash Deposits

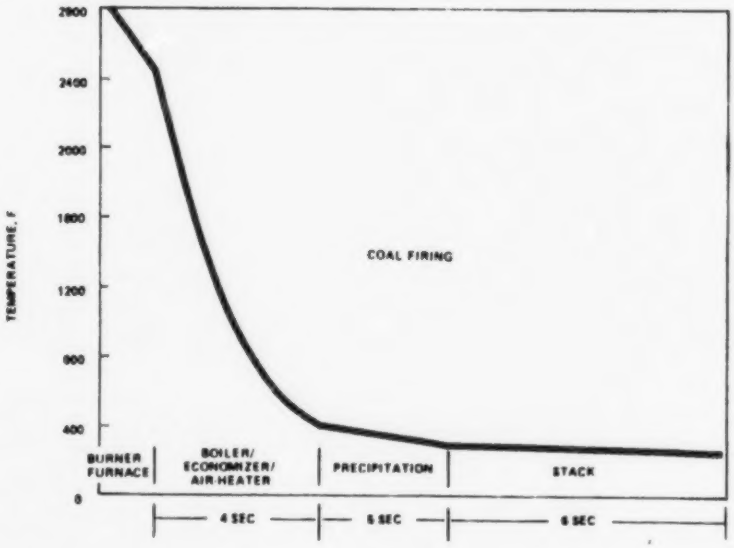

Figure 2. Flue-Gas Time-Temperature Profile

Erosion. Supplemental firing with shredded light fraction will generally result in slightly increased flue gas velocities (approximately 5 percent). The ash content of shredded light fraction is also generally higher than that of coal. The combined effect of greater velocity and ash loading could result in an increase in erosion potential.

Figure 2 shows a flue-gas time-temperature profile for a coal-fired unit. The residence time in the burner furnace area is relatively short (1 to 2 seconds). Complete combustion of the MSW light fraction is necessary in this zone to prevent carryover of unburned solid material into the convection zones, which could accelerate erosion rates and increase combustible carryover. Union Electric has not reported increased erosion as of this date in its No. 1 and No. 2 Meramec plant units.

Ash Handling and Emissions. The increase or decrease in ash loading depends upon the percentage of supplemental firing and the relative ash content of the coal and MSW light fraction fuel. If the ash content of the MSW light fraction were double that of the coal and the HHV wer half that of coal, the ash loading to the boiler would increase by 3 percent for each one percent of supplemental firing.

Experience at Union Electric was that fly ash remained salable to cement manufacturers. Bottom ash was not salable prior to installation of an air-classifier, owing to some large particles of metal, wood, plastics, and other materials.

Electrostatic precipitator performance was tested at Meramec with and without refuse firing (Figure 3). The results of these tests have stirred up considerable controversy, resulting in an agreement to retest the units. These tests were recently reviewed by a project group of members of the Industrial Gas Cleaning Institute for the Environmental Protection Agency.

It was agreed by the project group that the data made available by EPA had three major deficiencies:

1. The tests taken during mixed coal-refuse firing were characterized by an excessive spark rate. There was no evidence visible in either the data or the text of the reports that any effort was made to reduce or control the spark rate. It is possible that the precipitator performance was impaired by the excessive sparking.

2. The test data taken did not include complete electrical performance data for the precipitator. The absence of electrical data prevented a complete and definitive evaluation of the test results by the project group.

3. The test data on mixed-fuel firing at high boiler load were taken at unusually high face velocities through the precipitator, and these high velocities could have adversely affected the measured performance of the precipitator. This is the most serious of the three major deficiencies in the data.

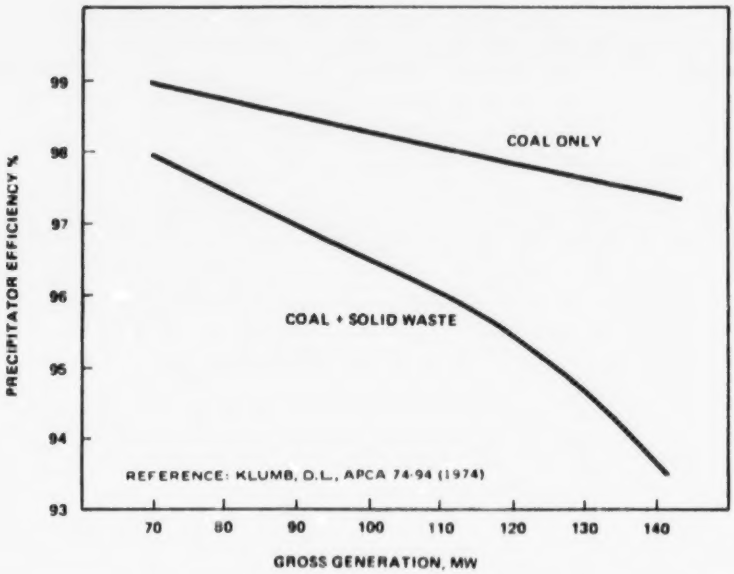

Figure 3. Meramec Unit No. 1: Precipitator Efficiency vs. Generation, Coal and Solid Waste Firing

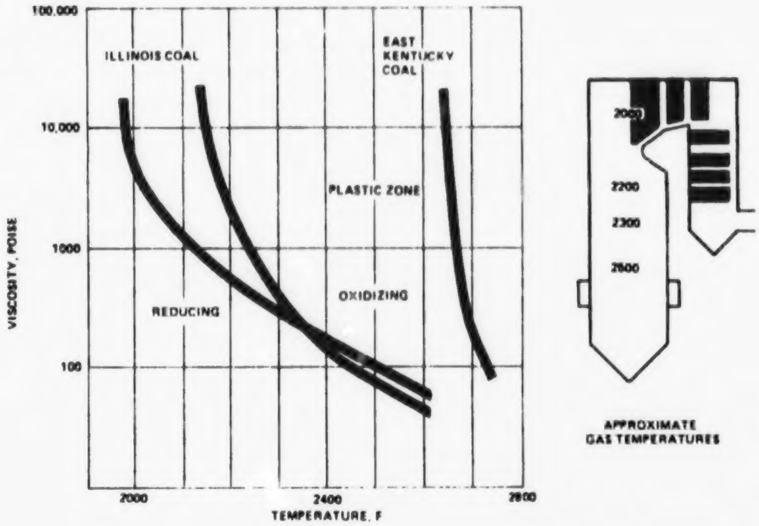

Figure 4. Viscosity/Temperature Relationship of Coal Ash

Despite these deficiencies, the project group agreed that the data from EPA, coupled with the judgement and experience of the precipitator manufacturing companies, could be used as the basis for precipitator design. It was generally felt that precipitator selections made on this basis would err, if at all, on the conservative side. Further testing is under way to resolve the uncertainties in the above data.

The lower sulfur content of the refuse would theoretically result in slightly lower concentrations of SO_x emissions because sulfur oxide emissions are almost directly related to the sulfur content of the material being oxidized. Unless the coal/light fraction combination could be burned at lower temperatures, which is doubtful, there would probably be no significant increase or decrease in NO_x emissions.

Slagging. A slagging index, using the viscosity/temperature relationship of a coal ash, is independent of ash composition and can be used for both eastern and western coals, as shown in Figure 4. The most troublesome form of slag is plastic slag. The plastic region begins between 100 and 500 poise and ends where the ash becomes solid - at about 10,000 poise. Approximate gas temperatures in the furnace are also shown in Figure 4. Placement and operation of soot blowers depends upon the slagging characteristics of the fuel for which the boiler was designed. MSW light fraction slagging characteristics could be very similar to those for the design fuel, as seems to be the case at Meramec (designed for Illinois coal). However, if the design fuel were East Kentucky coal, as shown in Figure 4, the difference in slagging could be pronounced.

There has been no indication to date from the St. Louis experience that solid waste fuel has any greater tendency to form slag than does Illinois bituminous coal. The ash fusion temperatures of solid waste apparently are about the same as those of Illinois bituminous coal. Utility personnel have voiced the opinion that the furnace appears to be cleaner when solid waste is fired in combination with coal than when coal is fired alone. Although the reason for this is not clear, it is assumed that paper forms a nonslagging dry ash.

GASEOUS REFUSE DERIVED EFFECTS ON BOILERS

Properties

The MSW-derived gases discussed here are very similar to gases derived from coal gasification processes as far as their use in utility boilers is concerned. The Union Carbide Purox gas has the same heating value as medium-Btu gas (MBG) derived from coal.

Since gases contain essentially no ash, they would comply with the particulate emission standards now in effect. There are no emission standards for SO_2 in the burning of these low- or medium-heat-content fuel gases. Although no NO_x data are available, EPA NO_x limits will probably not be exceeded when burning these fuels, according to statements made by others concerning LBG (low-Btu gas) and MBG (medium-Btu gas).

Other studies on converting existing boilers and newly designed units to burn LBG and MBG tend to confirm that there is relatively minor impact to existing boiler designs and performance.

Figure 5 shows the theoretical air required to burn 10,000 Btu of fuel and the flue gas per 10,000 Btu of fuel fired as the fuel value is varied from 0 to 1000 Btu/cu ft. Although the theoretical air shows a decreasing tendency as the Btu/cu ft value drops, the increased fuel volume results in an increased flue gas quantity, which becomes excessive for fuel gases below 300 Btu/cu ft.

Burners can be converted to handle gas of 300 Btu/cu ft or higher with very minor changes. When 300 Btu/cu ft of fuel gas is used, there is a negligible change in the volume of the flue gases. Hence, the heat absorption is not significantly affected. Figure 6 shows the change in unit efficiency for a boiler designed for natural gas when fired with a lower Btu gas. The efficiency actually increases, reaches a maximum at about 300 Btu/cu ft, and then falls off rapidly. This curve will vary, the variation depending on the particular unit and whether the unit was originally designed for coal, oil, or gas.

The following conclusions are considered regarding LBG and MGB utilization in existing units:

1. As the heating value of the fuel falls below about 300 Btu/cu ft, the fuel pipes or ducts increase in size, and as the size increases, it will be increasingly difficult to route these pipes or ducts.

2. There will be difficulty in enlarging the burners or increasing the number of burners to handle gas with heating value below 300 Btu/cu ft. In some cases, it may be physically impossible to do what may be required.

3. Units designed for coal firing can accommodate gas with a lower heating value than can units designed for natural-gas firing.

4. Some coal-fired units may be suitable for gas having a heating value as low as 130 Btu/cu ft, although there would be less difficulty if the gas had a heating value of at least 200 Btu/cu ft.

5. Natural-gas-fired units can burn gas of 300 Btu/cu ft or higher with only minor changes to the units.

6. It may be very expensive and perhaps impracticable to alter existing natural-gas-fired units to handle gas with heating values much below 300 Btu/cu ft.

7. Units designed for firing the better bituminous coals, oil, or a combination of fuels probably would fall between the conservative coal-fired units and the gas-fired units, and could burn gas with heating values somewhat less than 300 Btu/cu ft.

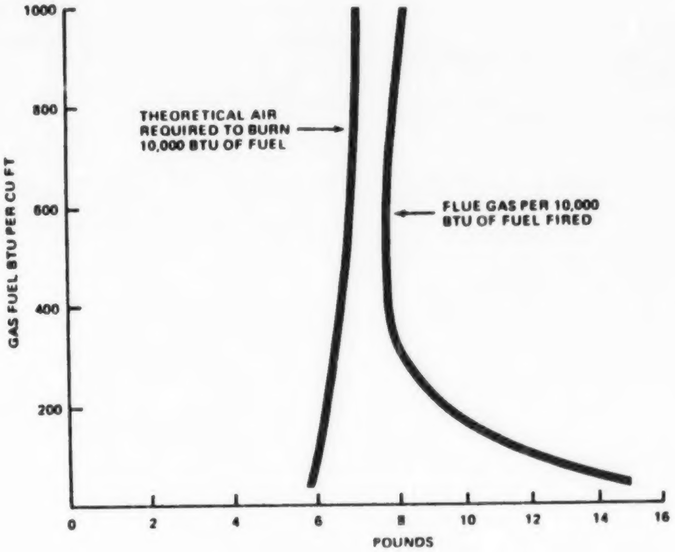

Figure 5. Theoretical Air and Flue Gas

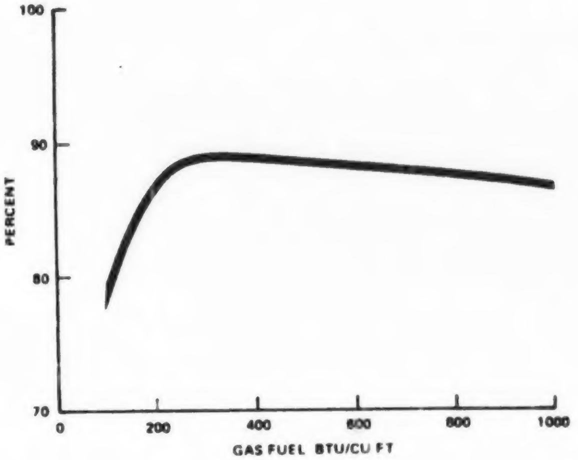

Figure 6. Unit Efficiency

8. Unit efficiency will decrease slightly because of increasing heat loss to the stack when gas with a heating value less than about 300 Btu/cu ft is burned.

From the above, it is apparent that MSW-derived gaseous fuels could be used effectively in existing and new utility boilers if the heating value were 300 Btu/cu ft or greater.

ESTIMATED COSTS FOR SELECTED LANDFILL SITES IN CHAUTAUQUA COUNTY, NEW YORK
1975

BUSTI LANDFILL SITE

1.	Acres Available	215 acres
2.	Estimated Site Life	
	- @ 100,000 tons per year	42 years
	- @ 200,000 tons per year	21 years
3.	Estimated Capital Costs	
	- includes costs associated with land, site development, building fencing, scales, equipment, engineering and 15% contingency	
	- @ 100,000 tons per year	$1,021,550
	- @ 200,000 tons per year	$1,110,900
4.	Estimated Operating Costs	
	- includes amortized payment of capital costs at 6.5%, personnel, equipment maintenance, equipment sinking fund, fuel, miscellaneous expenses, and 10% contingency	
	- @ 100,000 tons per year	$ 319,000
	- @ 200,000 tons per year	$ 385,400
5.	Estimated Operating Cost Per Ton	
	- @ 100,000 tons per year	$3.20 per ton
	- @ 200,000 tons per year	$1.95 per ton

ESTIMATED COSTS FOR SELECTED LANDFILL SITES IN CHAUTAUQUA COUNTY, NEW YORK
1975

ARKWRIGHT LANDFILL SITE

1.	Actual Acres Available	34.6 acres
2.	Recommend Acquire Additional Adjacent	100 acres
3.	Total Acres Considered	134.6acres
4.	Estimated Site Life	
	- @ 100,000 tons per year	50 years
	- @ 200,000 tons per year	25 years
5.	Estimated Capital Costs	
	- includes costs associated with land, site development, building fencing, scales, equipment, engineering and 15% contingency	
	- @ 100,000 tons per year	$760,100
	- @ 200,000 tons per year	$886,750
6.	Estimated Operating Costs	
	- includes amortized payment of capital costs at 6.5%, personnel, equipment maintenance, equipment sinking fund, fuel, miscellaneous expenses, and 10% contingency	
	- @ 100,000 tons per year	$271,300
	- @ 200,000 tons per year	$357,100
7.	Estimated Operating Cost Per Ton	
	- @ 100,000 tons per year	$2.75 per ton
	- @ 200,000 tons per year	$1.80 per ton

TRANSFER STATION COST - DUNKIRK AREA
(ALTERNATIVES A AND B, CHAPTER 7)
Transfer Wastes from Dunkirk to Jamestown

1. Transfer Station Cost

Building	$ 120,000
Compactors	39,000
Pit Conveyors	56,000
Front End Loader and Transfer Truck	90,000
	$ 305,000
20% Contingencies	61,000
TOTAL	$ 366,000

2. Trips/Day

Assume: 18 ton payload/trip

$\frac{127\ \text{TPD}}{18}$ = 7 trips/day

3. Tractor Cost

Assume: Operating Life - 5 years
Tractor efficiency - 4 MPG
Daily mileage - 400 miles/day
Annual mileage - 112,800 miles/year
Labor - 2 drivers

Capital Cost

2 tractors @ $30,000 ea.	$ 60,000

Annual Cost

Fixed Cost

$60,000 @ 8%, 5 years	$ 15,000
60,000 inflated @ 4%/year for 5 years = $73,000	
$73,000 sinking fund; 5.5%, 5 years	13,000
Labor ($11,000 x 2 + 35% benefits)	30,000
	$ 58,000

Variable Cost $0.37/mile

Annual fixed cost/tractor =	$ 29,000
Daily fixed cost =	$ 102/tractor

Trailer Cost

Capital Cost

2 trailers @ $27,000 ea.	$ 54,000.00

Fixed Cost

$54,000 @ 8%, 5 years	$ 13,500
54,000 - sinking fund @ 5.5%, 5 years	9,500
	$ 23,000

Annual fixed cost/trailer = $ 11,500
Daily fixed cost = $ 41/trailer
Variable cost = $ 0.14/mile

Transfer Station Operation

Capital Cost	$ 366,000

Fixed Cost

$366,000 @ 8%, 20 years	$ 37,500
2 Operators @ $10,000 + 25%	25,000
Utilities	
- Compactor & Conveyor Maintenance	8,000
- Electricity, etc.	5,000
Compactor, Conveyor, Front End Loader, and Transfer Truck @ $184,935 Sinking Fund - 5.5%, 10 years	14,500
Front End Loader and Transfer Truck Operation/Maintenance	25,000
TOTAL	$ 115,000

Total Transfer Cost

Fixed	Daily*	Annual
Tractors (2)	$ 204	$ 58,000
Trailers (2)	82	23,000
Transfer Station	408	115,000
Total	$ 694	$196,000
Variable Cost	400 mile/day	112,800 mile/year
Tractor ($0.37/mile)	$ 148	$ 41,800
Trailer ($0.14/mile)	56	15,700
Total	$ 204	$ 57,500

*282 Operating Days per year.

Total Cost for Operation

	Daily*	Annual
Fixed Cost	$ 694	$ 196,000
Variable Cost	204	57,500
TOTAL	$ 898	$ 253,500
Tons Transferred	127	35,814
Cost/Tons Transferred	$ 7.07	$ 7.07

*282 Operating Days per year.

TRANSFER STATION COSTS - JAMESTOWN AREA
(ALTERNATIVES D, AND E CHAPTER 7)
Transfer Wastes from Jamestown to Dunkirk

1. Transfer Station Cost

Building	$ 190,000
Compactors	39,000
Pit Conveyors	80,000
Front End Loader and Transfer Truck	90,000
	$ 399,000
20% Contingencies	80,000
TOTAL	$ 479,000

2. Trips/Day

Assume: 18 ton payload/trip

$\frac{211\ \text{TPD}}{18}$ = 12 trips/day

3. Tractor Costs

Assume: Operating Life - 5 years
Tractor efficiency - 4 MPG
Daily mileage - 680 miles/day
Annual mileage - 191,760 miles/year
Labor - 3 drivers

Capital Cost

3 tractors @ $30,000 ea.	$ 90,000

Annual Cost

Fixed Cost

$90,000 @ 8% for 5 years	$ 22,500
$90,000 inflated 4%/year for 5 years = $109,500	
$109,500 sinking fund - 5.5% for 5 years	19,600
Labor ($11,000 x 3 + 35% benefits)	44,600
	$ 86,700

Variable Cost $0.37/mile

Annual fixed cost/tractor = $ 28,900
Daily fixed cost = $ 103/tractor

4. Trailer Cost

Capital Cost

4 trailers @ $27,000 ea.	$108,000.00

Fixed Cost

108,000 @ 8%, 5 year	$ 27,100
108,000 sinking fund @ 5.5%, 5 year	19,300
	$ 46,400

Annual fixed cost/trailer = $ 11,600
Daily fixed cost = $ 41/trailer

Variable Cost = $ 0.14/mile

5. Transfer Station Operation

Capital Cost	$479,000

Fixed Cost

$479,000 @ 8%, 20 years	$ 48,800
2 Operators @ 10,000 + 25%	25,000
Utilities	
- Compactor and Conveyor maintenance	8,000
- Electricity, etc.	5,000
Compactor, Conveyor, Front End Loader and Transfer Truck @ $208,935 Sinking fund - 10 years @ 5.5%	16,000
Front End Loader and Transfer Truck Maintenance/Operation	25,000
TOTAL	$128,000

6. Total Transfer Cost

Fixed	Daily*	Annual
Tractors (3)	$ 309	$ 86,700
Trailers (4)	164	46,400
Transfer Station	455	128,000
Total	$ 928	$261,100

Variable Cost (To Dunkirk)	680 miles/day	191,760 miles/year
Tractor @ $0.37/mile	$ 250	$ 79,900
Trailer @ $0.14/mile	95	27,000
Total	$ 345	$ 97,900

*282 Operating Days per year.

Total Cost for Operation

	Daily*	Annual
Fixed Cost	$ 928	$ 261,100
Variable Cost	345	97,900
Total	$1,273	$ 358,000
Tons Transferred	211	59,500
Cost/Ton Transferred	$ 6.00	$ 6.00

*282 Operating Days per year.

RDF PROCESS RESIDUE HAUL COSTS
Jamestown Resource Recovery Facility to Busti Landfill

79 TPD of Residue

Assume: 18 Ton Payload/Trip

$$\frac{79\text{ TPD}}{18} = 5\text{ Trips/Day}$$

Tractor Cost

Assume: Tractor Efficiency = 4 MPG
Daily Mileage = 125 Miles/Day @ 25 Miles/Trip
Annual Mileage = 35,250 Miles/Year

Capital Cost

Capital cost of tractor is included with the Processing Plant capital costs from Table 5-1:

1.	Truck for roll on/roll off containers	$55,000
2.	Two 40 c.y. roll on/roll off containers	14,000
	Total	$69,000

Annual Costs:	-At 6% for 10 years	$ 9,400
	-Driver	14,000
	-Amortized cost for 2 containers (Table 5-2: $90,000-$21,000 = $69,000 at 5.5% for 5 years)	12,400
Total		$35,800

Variable Costs:

$0.37/Mile

Annual Fixed Cost/Tractor and Containers = $35,800
Daily Fixed Cost = $127

Total Cost

	Daily*	Annual
Fixed		
Tractor and two containers	$127	$35,800
Variable Cost	Daily	Annual
	125 Miles/Day	35,250 Miles/Day
Tractor @ $0.37/Mile	$ 46	$13,000

Total Cost for Operation

	Daily	Annual
Fixed Cost	$127	$35,800
Variable Cost	46	13,000
TOTAL COST	$173	$48,800
Tons Transferred	79	22,278
Cost/Ton Transferred	$2.20	$2.20

NOTE: Does not include landfill disposal cost at $2.20/ton, only haul cost to landfill.

*282 Operating Days per year.

RDF PROCESS RESIDUE HAUL COSTS
Dunkirk Resource Recovery Facility to Arkwright Landfill

79 TPD of Residue

Note: Fixed Costs are the same as those costs calculated for Jamestown Residue Haul Cost, however, the variable costs are slightly higher.

Therefore:

Round Trip = 30 Miles
Daily Mileage = 150 Miles/Day
Annual Mileage = 42,300 Miles/Year

Variable Cost	Daily*	Annual
	150 Miles/Day	42,300 Miles/Year
Tractor @ $0.37/Mile	$ 56	$ 15,600

Total Cost for Operation	Daily	Annual
Fixed Cost	$127	$ 35,800
Variable Cost	56	15,600
	$183	$651,400
Tons Transferred	79	22,278
Cost/Ton Transferred	$2.30	$2.30

NOTE: Does not include landfill disposal cost at $2.30 per ton, only haul cost to landfill.

*282 Operating Days per year.

BOARD of
PUBLIC
UTILITIES
City of Jamestown, New York

P. O. Box 700
Jamestown, New York 14701
November 13, 1975

Mr. John R. Luensman
Director
Department of Planning and Development
County Office Building
Mayville, New York 14757

Dear Mr. Luensman:

Re: Your Memo Dated October 24, 1975

The information on our boilers requested by Gilbert Associates was mailed to John Splendore today. A summary of our apprehensions concerning the use of a solid RDF in our boilers cannot be developed until statements from the manufacturers of our boilers on this possibility are supplied by Gilbert Associates.

The Board of Public Utilities will be willing to pay at least 75% of its prevailing average fuel cost per million BTU for a fuel developed from solid waste. At the present time, our coal costs are slightly over a dollar per million BTUs. The above percentage is based on no capital expenditures by the Board of Public Utilities and subject to negotiation when the type of fuel and other criteria are determined.

Very truly yours,

BOARD OF PUBLIC UTILITIES

James S Pullan

James S. Pullan,
Superintendent

TRANSFER STATION IN DUNKIRK WITH TRANSFER TO NIAGARA COUNTY
(Alternative E, Chapter 7)

Incoming Waste

211 TPD being transferred from Jamestown to Dunkirk in twelve - 65 cu. yd. trailers/day.

174 TPD - direct haul to transfer station in Dunkirk (Northern communities - Figure 6-3)

$$\frac{174 \text{ TPD}}{18} = 10 \text{ Loads/Day}$$

Transfer Station

Building	$ 120,000
Compactor	39,000
Pit Conveyors	56,000
Front End Loader and Transfer Truck	90,000
	$ 305,000
20% Contingencies	61,000
TOTAL	$ 366,000

Assume: Tractors supplied by Niagara County, i.e., pick up loaded trailer on way back to Niagara County and leave empty trailer at transfer station.

Assume: Tractor picks up loaded trailer 1/hour.

Total loads at Dunkirk Station

10 Northern Tier (Dunkirk)
12 Southern Tier (Jamestown)

22/Day Total

Need: 2 Trailers for Dunkirk area only.

Trailer Cost
Capital Cost

2 Trailers @ $27,000 ea.	$ 54,000

Fixed Cost

$54,000 @ 8%, 5 Years	$ 13,500
$54,000 Sinking Fund @ 5.5%, 5 Years	9,500
	$ 23,000

Annual Fixed Cost/Trailer = $11,500

Daily* Fixed Cost = $41/Trailer

Variable Cost = $0.14/Mile

Transfer Station Operation

Capital Cost	$ 366,000

Fixed Cost

$366,000 @ 8%, 20 Years	$ 37,500
2 Operators @ 10,000 + 25%	25,000
Utilities	
Compactor and Conveyor Maintenance	8,000
Electricity, etc.	5,000
Compactor, Conveyor, Front End Loader, and Transfer Truck @ $184,935 Sinking Fund - 5.5% @ 10 Years	14,500
Front End Loader and Transfer Truck Maintenance/Operation	25,000
TOTAL	$ 115,000

Total Transfer Cost

Fixed	Daily	Annual
Trailers (2)	$ 82	$ 23,000
Transfer Station	408	115,000
TOTAL	$ 490	$ 138,000

Variable Cost

Assume: 72 miles/round trip to Erie County, Buffalo, N.Y.
36 miles one way to Erie County, Buffalo, N.Y.
Dunkirk to Buffalo

10 trips per day (one way) - Dunkirk area wastes @ 360 miles/day

12 trips per day (one way) for Jamestown area wastes @ 430 miles/day

Dunkirk Wastes Only - 174 TPD	Daily*	Annual
	360 Miles	101,520 Miles
Trailer @ $0.14/Mile	$ 51	$ 14,200
(Tractor @ $0.37/Mile to Buffalo)	($ 133)	($ 37,500)

*282 Operating Days per year.

	Daily*	Annual
Dunkirk Fixed Cost	$ 490	$138,000
Dunkirk Variable Cost,		
trailer only	$ 51	$ 14,200
tractor only	($ 133)	($ 37,500)
Tons Transferred	174	49,100
Cost/Ton Transferred	$ 3.10	$ 3.10
(Tractor Cost/Ton Transferred to Buffalo)	($ 0.76)	($ 0.76)

Jamestown Wastes Only - 211 TPD	Daily	Annual
- Cost to transfer wastes from Jamestown to Dunkirk T.S.	$1,273	$ 358,000
Cost/Ton	$ 6.00	$ 6.00
- Transfer Wastes from Dunkirk to Buffalo (one way)	430 miles	121,800 miles
Trailer @ $0.14/Mile	$ 61	$ 17,000
(Tractor @ $0.37/Mile to Buffalo)	($ 160)	($ 45,100)
Jamestown Fixed Cost	$1273	$358,000
Jamestown Variable Cost (Transfer one way to Buffalo Only)		
trailer only	$ 61	$ 17,000
tractor only	($ 160)	($ 45,000)
Tons Transferred	211	59,500
Cost/Ton Transferred to Buffalo - trailer only	$ 6.30	$ 6.30
(Tractor Cost/Ton Transferred to Buffalo, one way)	($ 0.76)	($ 0.76)

*282 Operating Days per year.

	Daily*	Annual
COST SUMMARY		
Dunkirk Fixed Cost	$ 490	$ 138,000
Dunkirk Variable Cost - trailer only	51	14,200
Jamestown Cost to Dunkirk	1,273	358,000
Jamestown Variable Cost - trailer only	61	17,000
TOTAL	$1,875	$ 527,200
Total Waste Hauled (Tons)	385	108,570
Total Cost Per Ton - trailer only	$ 4.90	$ 4.90
(Dunkirk (one way) Tractor Cost to Buffalo)	($ 133)	($ 37,500)
(Jamestown (one way) Tractor Cost to Buffalo)	($ 160)	($ 45,100)
(Total Tractor Costs)	($ 293)	($ 82,600)
Incremental Tractor Cost Per Ton	($ 0.76)	($ 0.76)
Total Cost Per Ton (Tractor and Trailer)	$ 5.66	$ 5.66

*282 Operating Days per year.

NIAGARA MOHAWK POWER CORPORATION
APPRAISAL OF THE USE OF SOLID WASTE
AS SUPPLEMENTARY FUEL AT THE
C. R. HUNTLEY AND DUNKIRK STATIONS

SUMMARY AND CONCLUSIONS

This report, commissioned by the Niagara Mohawk Power Corporation, summarizes investigations made relative to the use of municipal solid waste from the Erie County, New York, area as supplementary fuel in existing coal-fired boilers at the C. R. Huntley and Dunkirk steam-electric power plants. The process upon which this report is based provides for the milling of mixed municipal solid waste to small particle sizes, the removal of the heavy, non-burnable fraction of the wastes, and the pneumatic firing of the light, burnable fraction directly to suitable utility boilers. As a joint undertaking by the City of St. Louis and the Union Electric Company, the process has undergone extensive testing at a prototype facility. Salient conclusions and recommendations resulting from the study are summarized in the following paragraphs:

1. The estimated total annual quantities of solid waste suitable for processing to produce supplemental fuel, and the quantities of supplemental fuel which would be produced from Erie, Niagara and Chautauqua Counties are as follows:

	Processable Waste		Supplemental Fuel	
	1979 tons	1988 tons	1979 tons	1988 tons
Erie County	825,000	868,000	619,000	651,000
Niagara County	186,000	206,000	139,000	154,000
Chautauqua County	98,000	101,000	74,000	76,000
Totals	1,109,000	1,175,000	832,000	881,000

2. The utility boilers which are most adaptable for burning solid waste as supplemental fuel are Units 67 and 68 at the Huntley Station and Units 1, 2, 3 and 4 at the Dunkirk Station. Conservative estimates of the annual quantities of supplemental fuel and the corresponding quantities of raw processable waste, firing the supplemental fuel 6 days per week, 16 hours per day, 270 days per year, and with full load fossil fuel replacement rates of 10 and 15 percent, are as follows:

	tons/year 10% Repl. Rate		tons/year 15% Repl. Rate	
	Suppl. Fuel	Raw Waste	Suppl. Fuel	Raw Waste
Huntley No. 67	83,430	111,240	125,280	167,130
Huntley No. 68	83,430	111,240	125,280	167,130
Total	166,860	222,480	250,560	334,260
Dunkirk No. 1	41,040	54,810	61,560	82,080
Dunkirk No. 2	41,040	54,810	61,560	82,080
Dunkirk No. 3	83,430	111,240	125,280	167,130
Dunkirk No. 4	83,430	111,240	125,280	167,130
Total	248,940	332,100	373,680	498,420
Both Plants	415,800	554,580	624,240	832,680

3. Even on the conservative basis upon which the refuse burning capability of the boilers was computed, the six units, at a 15 per cent fuel replacement rate, could consume all of the processable waste available in Erie County in 1979, and about 96 per cent in 1988. Essentially all of the processable waste within a convenient hauling distance of the processing facilities could be accommodated. A less conservative estimate of the burning capability of the boilers might permit portions of Niagara and Chautauqua Counties to be accommodated as well.

4. Operating experience at the Union Electric Company has indicated that a full load replacement rate of 10 per cent can be achieved easily and that a 15 per cent rate can be considered conservative. It is anticipated that initial operation of the subject project would be at the 10 per cent rate, with the probability that the 15 per cent rate would prove to be acceptable after suitable operating procedures are developed.

5. All six of the boilers considered adaptable for burning solid waste are equipped with new air pollution control equipment. No significant effects adverse to ambient air quality would be expected at either station. An evaluation made by the Erie County Department of Environmental Quality has confirmed this conclusion for the Huntley Station. Ambient air quality at the Dunkirk Station is considered less marginal than at Huntley.

6. Processing of the solid waste can be done most efficiently with two processing plants, one to serve the Huntley Station and one to serve the Dunkirk Station. The two plants would be essentially identical, with each consisting of two processing lines, thereby providing an acceptable level of redundancy. With the cooperation of the Erie County Division of Planning, the best site to serve the Huntley Station was determined to be on River Road, less than two miles from the power plant. The best site to serve the Dunkirk Station was determined to be near the interchange of State Route 5 and Mile Strip Road in Hamburg, about 40 miles from Dunkirk. Both sites are already industrially zoned.

7. The most appropriate means of transporting the supplementary fuel from the processing plants to the power plants is by means of self-unloading tractor-trailer units. This method of transport is flexible and adds to the redundancy of the system, since either processing plant could serve either power plant in case of emergencies.

8. Each of the two processing plants would have the capability of accommodating more than 2,000 tons of raw waste per day. The estimated costs of the proposed facilities, on a 1979 basis, are as follows:

	To Serve the Huntley Station	To Serve the Dunkirk Station
Processing Plants	$13,519,000	$13,519,000
Fuel Transport Vehicles	410,000	1,026,000
Facilities at Power Plants	8,856,000	13,319,000
Totals	$22,785,000	$27,864,000
Eligible for Grant	$18,584,000	$21,823,000
Maximum Grant (Potential)	$ 9,292,000	$10,911,000

The maximum grant, as noted in the preceding tabulation, is based upon 50 per cent of the estimated eligible cost, as defined by the State Department of Environmental Conservation.

9. The economic elements of the proposed process were examined upon several bases. Table A summarizes the combination of elements examined for the year 1979. The Huntley and Dunkirk Stations were considered separately. Fuel replacement rates of both 10 and 15 per cent were considered. Three bases of financing are shown; the first with complete financing by Niagara Mohawk; the second with public financing, except for modifications inside the power plant buildings, with no State grant-in-aid; and the third with public financing, assuming a maximum grant-in-aid from the State.

10. Each of the cases summarized in Table A includes a "required tipping fee." This figure may be compared to the tipping fees required for existing landfill operations, or for other alternate means of solid waste disposal. Present (1976) landfill tipping fees, controlled for the most part by private operators, are variable. In general, with the exception of certain long-term contracts, they are understood to be equivalent to $5 to $7 per ton of raw waste. By 1979, they can be expected to escalate 20 to 25 per cent.

11. The cost estimates included herein are considered to be quite conservative. It may be possible to reduce the capital requirement at the Huntley Station by about $2,500,000, and at the Dunkirk Station by $3,600,000. The operating cost estimates reflect two-shift operation of the processing plants. It is possible that with minor design

modifications, one-shift operation will be satisfactory, at least for a number of the cases. Other areas of conservatism are reflected in assumed boiler loadings and operating schedules.

12. The locations proposed for the processing facilities are relatively convenient to the more densely developed portions of Erie County, where most of the solid waste is generated. It is probable that these locations would permit shorter hauls for refuse collection trucks than the locations of long-range landfill sites.

13. The total annual credits shown in Table A are comprised of the value of the coal replaced by solid waste and the revenue accruing from the sale of recovered magnetic metal.

14. The economics of applying the process separately at either the Huntley or the Dunkirk Station would be about the same, despite the significant difference in transport distance.

15. The economics of a 15 per cent fuel replacement rate are far more attractive than for the 10 per cent rate. This is due to the greater quantities handled as well as because many of the costs would be the same for either case.

16. Utility financing results in net annual costs somewhat greater than those resulting from public financing. This is due to higher assumed interest rates as well as to the necessity for providing for taxes in utility financing.

17. Even without a State grant-in-aid, public financing would make the net costs of the proposed project attractive when compared to existing costs of landfill, particularly at a 15 per cent fuel replacement rate.

18. A grant-in-aid from the State of New York will further enhance the economic attractiveness of the proposed project. The project as proposed herein, expanded to over twice the capability of the project as originally conceived, would be potentially eligible for a grant-in-aid of over $20,000,000. (The current grant offer is in the amount of $7,000.000.)

19. The net annual costs are projected to be about the same in 1988 as they would be in 1979 for a 10 per cent fuel replacement rate. For a 15 per cent rate, 1988 costs would be significantly less than in 1979.

20. One of the principal uncertainties relative to the economics of the proposed project is the projected cost of coal. If the anticipated 7.0 per cent per year escalation rate were to be only 5.0 per cent per year, the 1979 gross value of the supplementary fuel would be $15.10 per ton instead of $15.90 per ton at the Huntley Station and $14.50 per ton instead of $15.30 per ton at the Dunkirk Station.

Table No. A

ECONOMIC SUMMARY
1979 BASIS

	Case A-1(1)	Case A-3(2)	Case B-1(3)	Case B-3(4)	Case C-1(5)	Case C-3(6)	Case C-5(7)
Fuel Replacement Rate	10%	15%	10%	15%	10%	15%	15%
	Huntley Station		Junkirk Station		Huntley and Dunkirk Stations		
WITH UTILITY FINANCING							
Fixed Charges (Util. Fin.)	$4,557,000	$4,557,000	$5,572,800	$5,572,800	$10,129,800	$10,129,800	$10,129,800
Annual Operating Costs	2,604,900	3,045,400	3,708,200	4,656,000	6,278,100	7,666,400	7,309,600
Total Annual Costs	$7,161,900	$7,602,400	$9,281,000	$10,228,800	$16,407,900	$17,796,200	$17,439,400
Total Annual Credits	$2,610,300	$3,919,800	$3,761,900	$5,645,800	$6,372,200	$9,567,500	$8,376,300
Net Annual Cost	$4,551,600	$3,682,600	$5,519,100	$4,583,000	$10,035,700	$8,228,700	$9,063,100
Tipping Fee Required $/ton	$20.46	$11.02	$16.62	$ 9.20	$18.10	$ 9.88	$12.43
WITH PUBLIC FINANCING (NO GRANT-IN-AID)							
Amortization (County Fin.)	$1,882,100	$1,882,100	$2,227,300	$2,227,300	$4,109,400	$4,109,400	$4,109,400
Fixed Charges (Util. Fin.)	569.000	569,000	854,000	854,000	1,423,000	1,423,000	1,423,000
Annual Operating Costs	2,604,900	3,045,400	3,708,200	4,656,000	6,278,100	7,666,400	7,309,600
Total Annual Costs	$5,056,000	$5,496,500	$6,789,500	$7,737,300	$11,810,500	$13,198,800	$12,842,000
Total Annual Credits	$2,610,300	$3,919,800	$3,761,900	$5,645,800	$6,372,200	$9,567,500	$8,376,300
Net Annual Cost	$2,445,700	$1,576,700	$3,027,600	$2,091,500	$5,438,300	$3,631,300	$4,465,700
Tipping Fee Required $/ton	$10.99	$ 4.72	$ 9.12	$ 4.20	$ 9.81	$ 4.36	$ 6.13
WITH PUBLIC FINANCING (WITH MAX. GRANT-IN-AID)							
Amortization (County Fin.)	$1,005,000	$1,005,000	$1,197,000	$1,197,000	$2,202,000	$2,202,000	$2,202,000
Fixed Charges (Util. Fin.)	569,000	569,000	854,000	854,000	1,423,000	1,423,000	1,423,000
Annual Operating Costs	2,604,900	3,045,400	3,708,200	4,656,000	6,278,100	7,666,400	7,309,600
Total Annual Costs	$4,178,900	$4,619,400	$5,759,200	$6,707,000	$9,903,100	$11,291,400	$10,934,600
Total Annual Credits	$2,610,300	$3,919,800	$3,761,900	$5,645,800	$6,372,200	$9,567,500	$8,376,300
Net Annual Cost	$1,568,600	$ 699,600	$1,997,300	$1,061,200	$3,530,900	$1,723,900	$2,558,300
Tipping Fee Required $/ton	$ 7.05	$ 2.09	$ 6.01	$ 2.13	$ 6.37	$ 2.07	$ 3.51

(1) Basis: Fuel prepared at North Plant, utilized at Huntley at 10% replacement rate.
(2) Basis: Fuel prepared at North Plant, utilized at Huntley at 15% replacement rate.
(3) Basis: Fuel prepared at South Plant, utilized at Dunkirk at 10% replacement rate.
(4) Basis: Fuel prepared at South Plant, utilized at Dunkirk at 15% replacement rate.
(5) Basis: Fuel prepared at Both Plants, utilized at both Huntley and Dunkirk at 10% replacement rate.
(6) Basis: Fuel prepared at Both Plants, utilized at both Huntley and Dunkirk at 15% replacement rate.
(7) Basis: Fuel prepared at Both Plants, utilized at both Huntley and Dunkirk at 15% replacement rate, modified to include only the more likely tributary areas from Erie County.